Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

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The New England Botanical Club, Inc.
8 and 10 West King St., Lancaster, Pa.
Room 1001, 53 State St., Boston, Mass.

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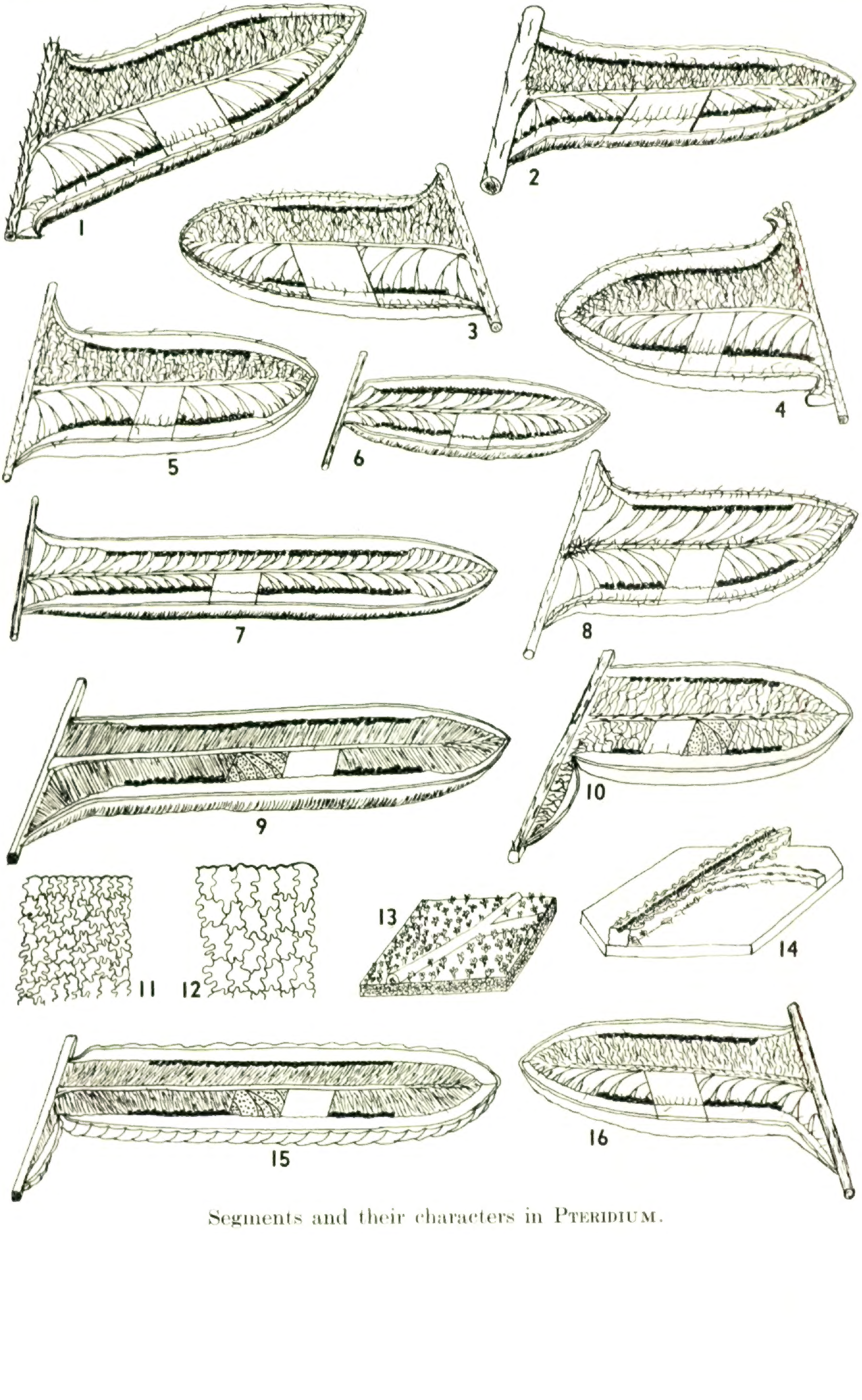

Segments and their characters in PTERIDIUM.

Rhodora

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A REVISION OF THE GENUS PTERIDIUM

R. M. Tryon, Jr.

(Plates 650–653)

INTRODUCTION

The only species of the monotypic genus *Pteridium, P. aquilinum,* is one of the most familiar plants in the world. Its distribution is world-wide in temperate and tropical regions and it is common to the point of becoming a weed in most of the regions in which it grows. Many authors complain of its weedy character in the British Isles, northwestern United States and New Zealand. In these regions and probably in others it invades fields and most especially pastures and it is probably the most obnoxious native weed with which the farmers have to deal. Apparently, it immediately assumes the role of a weed as soon as man tries to turn to his own uses any land that it finds suitable for its growth. However, the weedy character seems to vary with the variety, or region, for var. *latiusculum* and var. *pseudocaudatum* in eastern North America only rarely, if ever, become a serious menace to farmers.

Among the many species of ferns that spread by means of rhizomes or runners, the Bracken is particularly well adapted to the role of a weed. In favorable soil conditions there is a widely creeping, deep, main rhizome from which lateral, ascending branches arise. These branches usually rebranch and produce

the fronds fairly near the surface. A dormant bud is produced at the base of each frond so that each year the plant has a potential second set of fronds. If, through burning or plowing, the lateral branches are destroyed, the main deep-seated rhizome can continue the life of the plant.

A few excerpts from a recent article on the Bracken in Britain[1] will illustrate its economic importance as a weed and some of the methods taken to control it. "Bracken ranks as the most plentiful and widespread of British ferns. It is generally distributed in most rough grazings and in many old permanent pastures in almost every part of Britain. It is plentiful in most open woodlands and on the sites of formerly wooded areas. . . . Many of the older writers have dealt with the loss of grazing due to Bracken. . . . 'I have seen the Roots of it in some Grounds, eight Foot deep. The best cure is often mowing of it while in grass. If you plow it up, plentiful dunging of it and Ashes are very good: but the certainest cure for it is Urine.' *J. Mortimer*, The Whole Art of Husbandry, 2nd Ed., 1708." At the present time, the authors recommend cutting the fronds when they are fully mature and following this with heavy grazing; and also the use of phosphate and lime fertilizers to build up the ground and make it unsuitable for the growth of the Bracken. Sodium chlorate and sulphuric acid are recommended as killing sprays. "In closing this paper, however, the writers desire very definitely to record their view that the bracken menace has grown so rapidly, and has now attained such proportions, that it is of real national importance: at the International Grassland Congress of 1937 one speaker referred to it as 'the ghost stalking silently at our side, which nobody dares to discuss.' . . . A million pounds sterling devoted to the reduction of the area infested by bracken would be well spent."

Many species of fungi are parasitic upon *Pteridium aquilinum*[2] and attempts have been made to use them in its control. *Fusarium* sp. and *Corticium anceps* (Bres. and Syd.) Gregor have been tried[3] but due to the fact that the host seems to be

[1] Long and Fenton, The Story of the Bracken Fern. Journ. Royal Ag. Soc. Eng. **99**: 15–36 (1938).

[2] See Seymour, Host Ind. Fungi N. Am. (1929) and Faull, Gen. Urediniopsis. Contrib. Arn. Arb. **11** (1938).

[3] See Gregor in Verdoorn, Man. Pterid. 146 (1938).

more durable under varying environmental conditions than the fungus, they have not met with success.

To compensate for its economic liabilities, the Bracken has made itself available for many uses, though at the present time none are of real importance. The fronds have been used for stock-food, when mixed with grass; as silage; for packing fruits; in the place of hops in brewing; medicinally; in glass making and as litter for both man and stock. The fronds and rhizomes have been used in thatching and the green fronds burned as a source of potash. Nakai[4] says that in Java the fronds are laid on racks over the *Cinchona* beds to protect the young plants from the sun and that: "This shelter is not liable to rotten and decays harmoniously with the growth of the *Cinchona.* When *Cinchona* reaches to the height of the roof, it want the shelter no more, and the fronds are so good and perfect as they then become bones only, dropping all of the leaves." The rhizomes have been used in brewing a beer and also as swine-food. It is reported that the swine prefer the rhizome plus soil. The hairs from the base of the petiole of var. *caudatum* are used for stuffing pillows and the fronds are used as packing in the tops of charcoal bags. A solution of the boiled fronds has been used effectively as a rose spray. Bracken is often accused of being poisonous to stock but apparently this is true only when it is eaten exclusively and in large amounts. The rhizomes, which contain a considerable amount of starch, have been used as food, at one time or another, in Switzerland, France, Canary Islands, western North America, Society Islands, New Zealand, Tasmania, New South Wales and China. It is said that formerly it was an important food-item of the Maoris of New Zealand. One doctor is reported as using the starch in place of arrowroot. However, the ordinary rhizome would undoubtedly be poor fare and probably was usually eaten only to stave off actual starvation. Forster[5] says that: "Radices ab incolis inopibus et famelicis exsuguntur, insipidae, parum nutrientes lignoso-fibrosae." The croziers have been used as "asparagus" in Japan and western North America. A number of botanists have reported eating the broiled croziers and say the flavor is quite agreeable. I can

[4] Nakai, Critical Notes on Japanese Ferns. Bot. Mag. Tokyo **39**: 110 (1925).
[5] Forster, Pl. Escul. 74 (1786).

attest this myself but must add that the dense pubescence is rather troublesome.

In the Canary Islands, *Orobanche trichocalyx* (Webb & Berth.) G. Beck and *O. Schultzii* Mut. are parasitic upon *Pteridium aquilinum*.

Reproduction

Vegetative propagation by means of the creeping rhizome is the predominate method of reproduction of the Bracken, although in favorable localities ordinary sexual reproduction is quite as effective. Although the Bracken habitually grows in rather dry places these are apparently not suitable for its normal reproduction, the prothallial stage developing only in relatively damp situations. Long and Fenton[6] say that in the eastern side of Britain, the prothallial stage is rare or unknown, while in the western side, where there is considerably more rainfall, young plants are not uncommon. In eastern North America young plants are only rarely seen. The young stages are not common as herbarium specimens. It is an indication of their relative rarity that at least two species and one variety have been described on the basis of young plants, although their authors no doubt little suspected they were redescribing the familiar Bracken. If, in the past, the Bracken has reproduced largely by vegetative means, this might well explain its present vigor and the lack of specific segregation within the genus. Judging biological age by the number of generations, it would still be a relatively young species.

Nectaries

Nectaries are present at the base of the lower pinnae. These were apparently first noticed by Charles and Francis Darwin[7] but they have been mentioned by few authors[8] since then. I had an opportunity to observe them on var. *latiusculum* in the Harvard University Botanic Garden in the spring of 1940. On the sixth of May, the basal pinnae were just starting to unroll and

[6] *Op. cit.*

[7] Francis Darwin, Journ. Linn. Soc. **15**: 407, Tab. 6, Fig. 6 (1876).

[8] The only other original observation I have seen is that of Victorin, Les Filicinées du Québec. Contrib. Lab. Bot. Univ. Montréal No. 2, 71 (1923), who says: "Au printemps les nectaires basilaires des segments sont presque toujours visités par une grosse fourmi noire."

the nectaries were clearly visible at the base of the pinnae as dark brown, smooth, somewhat swollen areas on the dorsal side of the then densely pubescent rachis. As the fronds continued to unroll proportionately smaller nectaries could be seen at the base of the second and third pair of pinnae. These nectaries were functional in that they exuded a liquid in the form of droplets from small pores. The nectaries at the base of the second pair of pinnae were not as active as those below and those at the base of the third pair of pinnae seemed to be entirely inactive. Large red and black ants were attracted by the exudation and observed in considerable numbers feeding upon it. Although an analysis was not made, the fact that ants feed upon the liquid undoubtedly indicates that it contains sugar. A freehand section of the nectary area showed parenchymatous tissue but there was no evidence of glands. For these reasons I think it is likely that the exudation is neither a guttation of nearly-solute-free water nor a modified secretion but rather an excretion of the stipe-sap. The nectaries are active in the sun and also in the shade. They were quite active on a cloudy humid day. They were observed to remain active until the fronds were almost completely unrolled and may be active for a longer period of time. By midsummer they have become quite insignificant and entirely inactive. I believe this phenomenon is physiological, perhaps related to root pressure.

Primitive and Advanced Characters

Phylogenetically considered, *Pteridium* has a curious combination of relatively primitive external characters and relatively advanced internal characters. In the *Pteridoideae* it is considered to be a primitive genus[9] on the basis of the following characters: presence of a more or less vestigial inner indusium; initial basipetal succession of sporangia; hairs, but no scales, present on the rhizome; equal dichotomy of the axis in its early development; and open venation. On the other hand, the highly developed vascular structure of the stem and petiole and the presence of true vessels[10] indicate an advanced condition. The highly developed internal structure, however, is undoubtedly, at least in part, related to the relatively large size of the plant.

[9] See Bower, The Ferns. **3**: 41–45 (1928).

[10] Bliss, The Tracheal Elements in the Ferns. Am. Journ. Bot. **26**: 620–624 (1939).

Historical Account

Most of the taxonomic work on the Bracken has been done by authors working in a limited area or on a limited number of forms. There have been only a few comprehensive treatments. This has resulted in a general tendency to treat the various groups as species and to recognize, in one rank or another, trivial variations, a condition which naturally has led to a multiplicity of names. Not only has it been unnecessary to describe any new varieties in the present treatment, but in 1839 Agardh likewise found all of the groups he recognized already named. Most of the critical work has been done by local authors.

As in the case of so many groups, Linnaeus, Sp. Pl. **2** (1753), laid the foundations for the present treatment. He recognized, in the genus *Pteris,* two species, *P. aquilina* and *P. caudata,* which represent the ssp. *typicum* and *caudatum* of this treatment. Willdenow, Sp. Pl. **5** (1810) recognized, besides *Pteris aquilina* and *P. caudata,* some additional species described since 1753: *P. capensis, P. esculenta* and *P. lanuginosa.* Under *P. aquilina* he recognized, in var. *β,* a combination of var. *latiusculum* and var. *pseudocaudatum* of this treatment, but most later authors did not take up this segregate.

Agardh, Rec. Pterid. (1839) was the first author really to study material from most of the regions of the world and his treatment is in close agreement with the present one although he regarded most of the groups as species. He followed Linnaeus in treating the Brackens under the genus *Pteris,* but set them apart from the other species as the section *Ornithopteris.* He recognized *P. esculenta, P. arachnoidea, P. caudata* and *P. decomposita* and applied the names in essentially the same sense as in the present treatment. In *P. semihastata* and *P. recurvata* he recognized, respectively, var. *yarrabense* and var. *Wightianum.* Under *P. aquilina* he mentioned, but did not describe, var. *pseudocaudatum.* In the main his treatment differs from the present one only in the recognition of *P. lanuginosa* and in uniting var. *latiusculum* with *P. aquilina.* Later authors would have done well to follow Agardh's treatment more closely.

Hooker, Sp. Fil. **2** (1858) presented the next, and really the last, comprehensive treatment of the genus. He followed Agardh in treating the species under section *Ornithopteris* of *Pteris,* but

except for *P. coriifolia* and *P. psittacina,* which he says he did not understand, having seen no specimens, he reduced all names under *P. aquilina* and recognized only varieties. The present treatment agrees with his in this respect, but his varietal lines were rather poorly drawn. All varieties in the present ssp. *typicum* he treats under var. *glabra,* fronds glabrous or nearly so beneath, and var. *lanuginosa,* fronds quite pubescent beneath. In the present ssp. *caudatum* he recognized var. *caudata,* applying it in the present sense, and var. *esculenta,* including the present var. *esculentum,* var. *arachnoideum* and var. *yarrabense.* This treatment was long followed and led especially to a confusion of var. *esculentum* of Polynesia, Australia and New Zealand and var. *arachnoideum* of South America.

Diels, Nat. Pfl. **1**[4] (1899) and Christensen, Ind. Fil. (1905) recognized the single species *Pteridium aquilinum.* Nakai, *op. cit.* (1925) in a rather rambling and non-critical discussion, made several new combinations under *Pteridium,* reviewed much of the literature and discussed the status of various species and varieties.

Under various names, Scopoli, Fl. Carn. (1760), Gleditsch, Syst. Pl. (1764), Newman, Phytol. **2** (1845) and John Smith, Hist. Fil. (1875) separated the present genus *Pteridium* from *Pteris,* but it was not until Kuhn in v. d. Decken, Reis. Ost.-Af. **3**[3] (1879) took up and defined *Pteridium* that the Brackens were widely treated as a distinct genus.

Terminology

Certain terms have been used in the descriptions in a strictly limited sense and certain unusual terms and characters have been used. These are explained below:

The *vernation* of the frond *equal,* all of the pinnae becoming unrolled at essentially the same time; *subgleichenioid,* the tips of the upper pinnae still inrolled while the lower pinnae are completely unrolled; or *gleichenioid,* the basal pinnae being completely unrolled while the third or fourth pair of pinnae are completely inrolled.

A *costa* is the midnerve of a pinna.

A *costule* is the midnerve of any segment of lesser order than a pinna, with the exception of the midnerve of the ultimate segments, which is called the *midnerve.*

In some varieties there are lunate or sublunate, entire lobes along part of the rachis, costae and costules, between the divisions of the blade. These are called *free lobes.* Plate 650, fig. 10.

The *ultimate segments* are *adnate,* broadest, but not dilated, at the base (pl. 650, fig. 7); *decurrent,* dilated at the base toward the base of the midnerve (pl. 650, fig. 16); *surcurrent,* dilated at the base toward the tip of the midnerve (pl. 650, fig. 3); or *narrowed* at the base (pl. 650, fig. 6).

The *upper surface* of the ultimate segments includes the midnerve but excludes the margin.

The *margin,* although morphologically on the upper surface of the segment, is described separately. It is the chlorophyll-bearing tissue closest to the base of the outer indusium.

Peculiar, irregular, wing-like epidermal outgrowths occur on the veins and midnerve on the lower surface of the ultimate segment in some varieties. These are called *membranous wings* Plate 650, fig. 14.

Some varieties have a *farinaceous appearance* on the lower surface of the ultimate segments. This is a minute epidermal outgrowth, occurring between the veins, which, under high magnification, resembles a sparsely branched coral fungus. It may be an excretion but it is not affected by alcohol or dilute acid. Plate 650, fig. 13.

The term indusium is applied to the outer, functional indusium, the modified margin of the segment. The outer indusium is present in both fertile and sterile fronds and throughout partially fertile fronds. If it covers sporangia it is spoken of as the *fertile indusium,* if not, as the *sterile indusium.* The inner indusium is non-functional and usually nearly obsolete. When the inner indusium is meant it is called such.

The costules and lower side of the midnerves in ssp. *caudatum* are described as pubescent with white, dark or bicolorous hairs. The *white hairs* are long, thin, terete, whitish, multicellular hairs with oblique cross-walls. These are essentially of the same type that occur on the tissue on the lower surface of the segments. The *dark hairs* are rather large, stout, dark or reddish brown, usually terete, multicellular hairs with straight cross-walls, which are similar to those that occur on the rhizome. As these mature they often become moniliform, with whitish walls, only the septae

remaining brown. These are called *bicolorous hairs*. When one of these dark or bicolorous hairs breaks off, it often leaves a swollen base that is dark reddish brown and has the appearance of a sessile gland.

Systematic Treatment

Although *Pteridium* is world-wide in distribution and the various populations show very strong phytogeographic affinities, and although it is undoubtedly a rather old genus, three lines of evidence lead me to believe that specific segregation has not taken place. First, in all areas where two varieties of the same subspecies overlap in range intermediate specimens are found (with the exception of var. *africanum* in ssp. *typicum*). Such intermediates are not common but they are of such frequency that, assuming indiscriminate rather than critical collecting, they must form a percentage of the *Pteridium* population of the area that cannot be overlooked. Second, in areas occupied exclusively by one variety, individuals, perhaps representing local populations, occur that have one or more characters of some other variety. That is, characters of one variety crop up occasionally in other varieties. In some cases a specimen will resemble another variety so closely that it would certainly be identified with it except by using the geographic "character." In other words, the critical characters of the varieties are not thoroughly stable. Third, the critical characters show little constancy within the group as a whole. That is, ciliation of the indusium in var. *Feei*, or non-ciliation in var. *africanum*, are critical characters but both conditions are commonly found in var. *caudatum;* pubescence on the undersurface of the blade in var. *pubescens* and the lack of it in var. *latiusculum* are critical characters, but var. *Wightianum*, while most commonly pubescent, is not infrequently nearly glabrous; pubescence on the margin of the segments in var. *Feei* and the lack of it in var. *typicum* are important characters, but var. *Wightianum* frequently exhibits both conditions; and the free lobes in var. *arachnoideum* and their absence in var. *caudatum* are diagnostic characters but both conditions are found in var. *yarrabense*. It seems to me that, when the critical characters of a group show such inconstancy, they are materially weakened for use in specific segregation.

The treatment of each variety follows a fixed order somewhat different from the conventional one. First, the accepted name and its synonymy and then any necessary discussion of the nomenclature. Second, the description of the variety followed by a discussion of taxonomic problems and a comparison with closely related varieties. Third, a short phytogeographic discussion, if desirable, a statement of habitat preference and a general statement of range. Last, a citation of specimens. In this arrangement, the critical discussion of nomenclature and taxonomic problems follows the synonymy and description, respectively; and the usually long citation of specimens comes at the end.

This study is based on the 2,500 sheets of *Pteridium* in the Gray Herbarium, the Herbarium of the New York Botanical Garden, the United States National Herbarium and the Herbarium of the Field Museum of Natural History.

Descriptions

The critical characters in the descriptions have been italicised. The descriptions are based on mature specimens and do not take into account juvenile forms. The cutting of the blade is the same in the juvenile state of all varieties. The margins of the segments are flat, not revolute, and there is no sterile indusium. None of the various epidermal outgrowths are present except pubescence, and that is only weakly developed and not distinctive.

Maps

The maps of the varieties have been compiled primarily from the cited specimens. These localities have been augmented by localities taken from other specimens examined and in a few cases by localities taken from the literature. These are used only when a specific locality was mentioned and where there was no doubt as to the identity of the variety. Localities based on specimens are indicated by a dot and those based on a printed record by a cross. The map of the species includes all of the localities on the varietal maps and in addition several localities taken from the literature where the identity of the variety was in doubt. On this map no distinction is made between localities based on specimens and those based on the literature. No attempt has been made to make the maps absolutely complete.

The series of specimens studied has in most cases been sufficient to plot the general range of each variety. The maps used have been selected from Goode's Series of Base Maps, Henry M. Leppard, Editor, Copyright by the University of Chicago, published by the University of Chicago Press.

Citations of Specimens

The citations of specimens have been limited, when necessary, to two or three from each minor political division, i. e. state, province or department. The most widely distributed collections are cited in preference to the more locally distributed ones. Full citations are given in the discussions only for specimens that are not listed in the formal citations. Herbarium-sheet numbers, such as, Herb. Field Mus. no. 47805, are used in cases where the data on the label is insufficient to identify the specimen accurately. The usual abbreviations for the herbaria are used: F, for the Herbarium of the Field Museum of Natural History, Chicago, Ill.; G, for the Gray Herbarium, Harvard University, Cambridge, Mass.; NY, for the Herbarium of the New York Botanical Garden, Bronx Park, N. Y.; and US, for the United States National Herbarium, Smithsonian Institution, Washington, D. C. In the few cases where other herbaria are cited, abbreviations are not used.

Acknowledgements

I wish to thank Dr. P. C. Standley, Dr. H. A. Gleason and Dr. W. R. Maxon for the generous loan of material and for privileges extended at the herbaria under their care; and especially to express appreciation to Mr. C. A. Weatherby, without whose constant help and encouragement this study could scarcely have been completed.

SYSTEMATIC TREATMENT

PTERIDIUM Gled. ex. Scop. Fl. Carn. Ed. 1, 169 (1760), nomen abortivum(?); Kuhn in v. d. Decken, Reisen in Ost-Afrika **3**[3]**:** 11 (1879).

Pteris L. Sp. Pl. **2:** 1073 (1753), in part. *Filix* Ludwig, Instit. Hist. Ed. 2, 149 (1757), nomen dubium; sensu Woynar, Hedwigia **56:** 383 (1915). *Cincinalis* Gled. Syst. Pl. 290 (1764), emend Trevis. Atti Soc. Ital. sc. nat. **17:** 239 (1875). *Asplenium* Bernh. Schrader's Journ. **1799**[1]**:** 309 (1799), in part. *Allosorus* Bernh.

Schrader's neues Journ. **1**[2]**: 36** (1806), sensu Pr. Tent. Pterid. 151 (1836), in part. *Paesia* St.-Hil. Voy. Brésil **1: 381** (1833), sensu Moore, Gard. Chron. 878 (1858), in part. *Eupteris* Newm. Phytologist **2: 278** (1845). *Ornithopteris* (Ag.) J. Sm. Hist. Fil. 297 (1875). *Aquilina* Pr. ex Diels in Engl. & Prantl, Nat. Pfl. **1**[4]**: 296** (1899), in synonymy. *Filix-foemina* Farwell, Am. Mid. Nat. **12: 290** (1931).

Although it is generally considered that Scopoli took up *Pteridium* Gled. for the Bracken, as a segregate genus from *Pteris* L., and it would therefore be the earliest valid generic name under the International Rules, some have argued that he proposed it as a substitute name for *Pteris* L. In order to meet this argument, *Pteridium* has been conserved (International Rules of Botanical Nomenclature, 131 (1935)).

Rhizome subterranean, extensively creeping, repeatedly branched, *invested with hairs but not scales,* the stele a perforated solenostele, true vessels present; *fronds alternate, large;* stipe relatively long, the *vascular bundles numerous; blade coarse,* pinnately divided, usually tripinnate, the lower pinnae with nectaries at the base; the segments very numerous, ovate to linear, the margin revolute; *veins free; sori marginal, mostly continuous; sporangia borne between the outer indusium, the modified margin of the segment, and the inner indusium;*[11] receptacle a vascular strand connecting the vein-ends, the inner indusium arising at its inner side; spores brown, very finely spinulose, tetrahedral-globose.—Represented by a single world-wide species, found in all temperate and tropical regions.

Pteridium aquilinum (L.) Kuhn in v. d. Decken, Reisen in Ost-Afrika **3**[3]**: 11** (1879). Map 1. Bracken.
Characters of the genus.

Key to the Subspecies and Varieties[12]

a. Ultimate segments adnate, or equally decurrent and surcurrent, or surcurrent, or narrowed at the base, not having a farinaceous appearance beneath; pubescence of the lower surface lanuginose or absent. (ssp. *typicum*) *b.*
b. Fertile and sterile indusium ciliate, or pubescent on the outer surface, or both; ultimate segments densely or sparsely pubescent beneath between the margin and the midnerve; pinnules nearly at right angles to the costae. *c.*

[11] The inner indusium is quite variable in its structure. In some specimens it is a continuous membrane, as figured by Luerss. in Rabenh. Krypt. Fl. Ed. 2, **3**: 101, fig. 81 and Bower (after Luerss.), The Ferns, **3**: 43, in others it is an irregularly broken membrane and in some it consists only of a few hairs.

[12] The user can expect that a considerable number of intermediate and non-typical specimens, especially shade-forms, will not run down satisfactorily.

c. Pinnae and pinnules long-acuminate; ultimate segments falcate or subfalcate; fertile indusium 0.3 mm. or less wide, the sterile 0.2 mm. or less wide (India to Java, New Guinea and Formosa)...2. var. *Wightianum*, p. 22

c. Pinnae and pinnules short-acuminate to obtuse; ultimate segments straight; fertile indusium 0.3 mm. or more wide, the sterile 0.2 mm. or more wide. *d*.

d. Upper surface of the ultimate segments glabrous or subglabrous, or if pubescent, the margin glabrous. *e*.

e. Rachis more or less pubescent; blade lanuginose beneath (Europe, Africa and adjacent islands). 1. var. *typicum*, p. 15

e. Rachis glabrous; blade subappressed-lanuginose beneath (Hawaiian Islands) .... 5. var. *decompositum*, p. 40

d. Upper surface of the ultimate segments pubescent, at least near the margin, and the margin pubescent. *f*.

f. Sterile indusium 0.4 mm. or more wide; the fertile portion of the indusium no broader than the sterile on the same segment (Mexico, Guatemala and Honduras) .... 4. var. *Feei*, p. 37

f. Sterile indusium 0.25 mm. or less wide; the fertile portion of the indusium broader than the sterile on the same segment (western North America and northern Mexico)...3. var. *pubescens*, p. 26

b. Fertile and sterile indusium glabrous; ultimate segments glabrous beneath between the margin and the midnerve, or slightly pubescent on part of the segment; pinnules at an oblique angle to the costae. *g*.

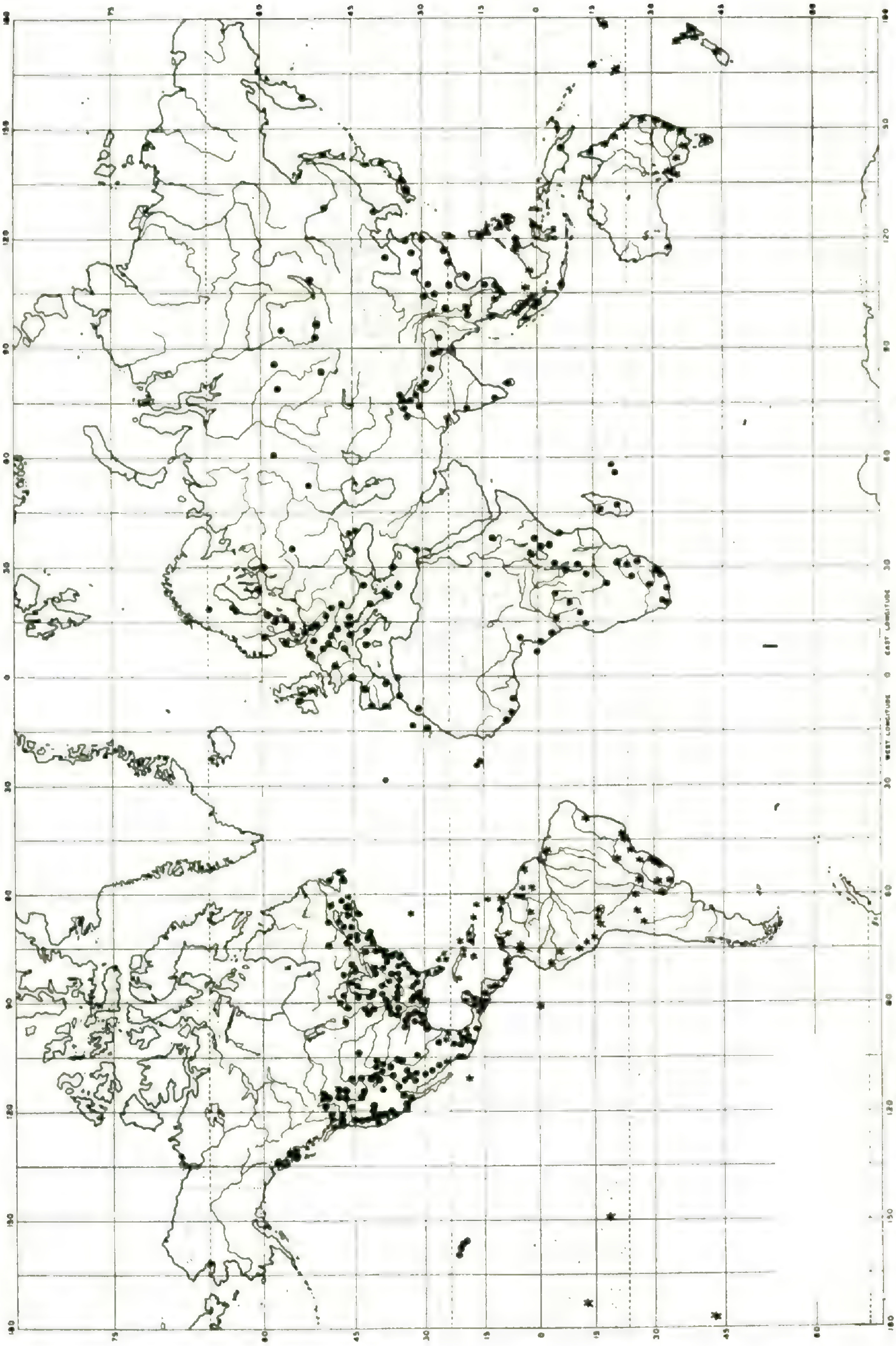
g. Blade usually quadripinnate, ovate; most of the ultimate segments narrowed at the base, the midnerve beneath glabrous or subglabrous (Africa) .... 8. var. *africanum*, p. 51

g. Blade usually bipinnate-pinnatifid or tripinnate, rarely tripinnate-pinnatifid, broadly triangular; the ultimate segments adnate or more often broadest at the base, the midnerve beneath moderately pubescent, sometimes glabrous. *h*.

h. Margin of the ultimate segments moderately pubescent; longest entire segment or entire part of a segment about four times as long as broad; the terminal segments mostly 5–8 mm. wide (North America, northern Europe and eastern Asia). 6. var. *latiusculum*, p. 41

h. Margin of the ultimate segments glabrous or subglabrous; longest entire segment or part of a segment about nine times as long as broad; the terminal segments mostly 2–4.5 mm. wide (southern and eastern United States)..7. var. *pseudocaudatum*, p. 48

a. Some of the ultimate segments decurrent only, or more strongly decurrent than surcurrent, usually having a farinaceous appearance beneath; pubescence of the lower surface straight, appressed or arachnoid, rarely sublanuginose or absent (ssp. *caudatum*). *i*.



Map 1. Range of Pteridium aquilinum, ssp. typicum(●) and caudatum(*).

i. Ultimate segments having a farinaceous appearance beneath, except in some glabrous forms; pubescence straight, appressed or arachnoid beneath. *j.*

j. No free lobes present on the rachis, costae and costules; the midnerve on the lower surface of the ultimate segments usually glabrous; fertile portion of the indusium broader than the sterile on the same segment; cells of the sterile indusium in rather definite rows, large, averaging 31 per mm. on the margin, the indusium not more than 5 cells wide (southernmost United States, West Indies, Mexico, Central America and northern South America) .... 9. var. *caudatum*, p. 54

j. Free lobes present on the rachis, costae and costules; the midnerve on the lower surface of the ultimate segments usually dark-pubescent; fertile portion of the indusium usually not broader than the sterile on the same segment; cells of the sterile indusium irregularly arranged, small, averaging 48 per mm. on the margin, the indusium at least 6, usually 8 cells wide. *k.*

k. Undersurface of the segments with membranous wings on the veins and midnerve, arachnoid-pubescent; margin of the segments often pubescent (West Indies, Mexico, Central America and South America) .... 10. var. *arachnoideum*, p. 57

k. Undersurface of the segments without membranous wings on the veins and midnerve, appressed-pubescent with straight hairs; margin of the segments glabrous (Australia, New Zealand and Polynesia). 11. var. *esculentum*, p. 61

i. Ultimate segments not having a farinaceous appearance beneath, sublanuginose-pubescent beneath (India to Sumatra, Philippine Islands and northeastern Australia) .... 12. var. *yarrabense*, p. 63

PTERIDIUM AQUILINUM ssp. **typicum**

Growing tip of the rhizome usually with a tuft of dark hairs, sometimes naked; rachis glabrous to densely pubescent; pinnules at right angles or at an oblique angle to the costae; *ultimate segments* broadly ovate to oblong, sometimes linear, *adnate or surcurrent, or equally surcurrent and decurrent, or narrowed at the base*, the upper surface glabrous to quite pubescent, the *lower surface lanuginose-pubescent or glabrous, not having a farinaceous appearance;* cells of the sterile indusium of medium size, usually irregularly arranged. MAP 1 (dots).

1. PTERIDIUM AQUILINUM var. **typicum**,[13] PLATE 650, FIG. 2,

[13] Only the more important, the more obscure and scattered, and the more widely used subspecific names and combinations are cited. About one hundred new subspecific names and combinations in Lowe, *Our Native Ferns*, Druery, *British Ferns and their Varieties*, Junge, *Die Pteridophyten Schleswig-Holsteins*, Kaulfuss, *Die Pteridophyten* and Gandoger, *Flora Europae terrarumque adjacentium* are omitted from the synonomy. Some names from other well known but less detailed works are also omitted. All of these names apparently represent trivial variations. Gandoger's treatment (*op. cit.* **27**: 180 (1891)), the opening portion of which is here quoted, amounts almost to a naming of individuals:

PLATE 651, FIG. 4, MAP 4. Illustrations: Fl. Dan. **13:** t. 2303 (1840); Waldner, Deutschl. Farne t. 17 (1883); Schk. Krypt. Gew. t. 95 (1809); Lowe, Native Ferns **2:** 407, t. 61 (1867); Marloth, Fl. S. Africa **4:** pl. 37 (1915), *habitat.*

Pteris aquilina L. Sp. Pl. 1075 (1753). *Cincinalis aquilina* (L.) Gled. Verm. Abh. **1:** 24 (1765), reference taken from Woynar, Hedwigia **56:** 381 (1915). *Pteris nudicaulis* Güld. Reisen Russ. **1:** 421 (1787), according to C. Chr. Ind. Fil. 603 (1906). *Pteris borealis* Salisb. Prod. 402 (1796). *Asplenium aquilinum* (L.) Bernh. Schrader's Journ. **1799**^{1}**:** 310 (1799). *Pteris capensis* Thunb. Prod. **2:** 172 (1800); fragment of type at NY. *Pteris lanuginosa* Bory ex Willd. Sp. Pl. **5:** 403 (1810); fragment of type at NY. *Pteris aquilina* L. var. *ciliata* Opiz, Kratos **2**^{1}**:** 19 (1820).[14] *Pteris aquilina* L. var. *sinuata* Opiz, Kratos **2**^{1}**:** 19 (1820). *Pteris foemina* Gray, Nat. Arr. Brit. Pl. **2:** 16 (1821). *Allosorus aquilinus* (L.) Pr. Tent. Pterid. 153 (1836). *Allosorus lanuginosus* (Bory ex Willd.) Pr. Tent. Pterid. 154 (1836). *Allosorus hottentottus* Pr. Tent. Pterid. 154 (1836). *Allosorus acutifolius* Pr. Tent. Pterid. 154 (1836), nomen nudum. *Allosorus villosus* Pr. Tent. Pterid. 154 (1836), nomen nudum. *Allosorus tauricus* Pr. Tent. Pterid. 154 (1836), nomen nudum. *Pteris brevipes* Tausch, Flora **19**^{2}**:** 427 (1836). *Pteris lanuginosa* Bory ex Willd. var. *capensis* (Thunb.) Ag. Rec. Pterid. 51 (1839). *Pteris plebia* R. Br. ex Ag. Rec. Pterid. 52 (1839), in synonymy. *Pteris coriifolia* Kze. Linnaea **18**^{2}**:** 120 (1844). *Pteris aquilina* L. var. *vera* Moore, Handb. Brit. Ferns, Ed. 1, 134 (1848), reference taken from Moore, Pop. Hist. Brit. Ferns, 167 (1851). *Pteris aquilina* L. var. *integerrima* Moore, Handb. Brit. Ferns, Ed. 1, 134 (1848), reference taken from Moore, Pop. Hist. Brit.

"20. Pteris L.

1. PTERIS AQUILINA L.
Hab. Europa tota.

1	Lobi sup. integri 4 mm. longi	2
	Lobi sup. integri 5 mm. longi	5
	Lobi sup. integri 6 mm. longi	8
	Lobi sup. integri 7 mm. longi	17
	Lobi sup. integri 8 mm. longi	28
	Lobi sup. integri 9 mm. longi	34
	Lobi sup. integri 10 mm. longi	40
	Lobi sup. integri 11 mm. longi	45
	Lobi sup. integri 12 mm. longi	47
	Lobi sup. integri 14 mm. longi— *Dordogne, Payzac* (Gdgr.)	*Pteris attenta* Gdgr.
2	Pinnae remoti	3
	Pinnae contiguae	4
3	Lobi obtusi- *Pedem., Vallées Vaudoises* (Rostan)	*P. polystichoides* Gdgr.
	Lobi acuti- *Basses-Pyren., m. Lestibette* (Gdgr.)	*P. oreodoxa* Gdgr."

[14] I am indebted to Prof. Dr. Adolf Pascher for the references to Kratos, a periodical apparently not in the United States.

Ferns, 167 (1851). *Pteris aquilina* L. var. *pubescens* Spreng. ex Liebm. Vid. Selsk. Skr. s. 5, **1:** 225 (1849), as to basinym, *Pteris lanuginosa* Bory ex Willd., not as to plant. *Pteris aquilina* L. var. *multifida* Moore, Handb. Brit. Ferns, Ed. 3, 226 (1857). *Pteris aquilina* L. var. *crispa* Moore, Handb. Brit. Ferns, Ed. 3, 226 (1857). *Pteris aquilina* L. var. *pubescens* Afz. fil. ex Hook. Sp. Fil. **2:** 198 (1858), in synonymy. *Pteris aquilina* L. var. *lanuginosa* (Bory ex Willd.) Hook. Sp. Fil. **2:** 196 (1858). *Allosorus capensis* (Thunb.) [incorrectly attributed to Presl by] Pappe & Raws. Syn. Fil. 32 (1858). *Allosorus coriifolius* (Kze.) Pappe & Raws. Syn. Fil. 31 (1858). *Paesia coriifolia* (Kze.) Moore, Gard. Chron. **1858:** 878 (1858). *Aquilina vulgaris* Pr. ex Milde, Fil. Eur. 45 (1867), in synonymy. *Pteris Heredia* Clem. ex Colm. Enum. crypt. Esp. y Port. **1:** 16 (1867), reference taken from C. Chr. Ind. Fil. 599 (1905) and Colmeiro, Enum. Plantas Hisp.-Lusit. **5:** 437 (1889). *Paesia aquilina* (L.) Keys. Pol. Cyath. Hb. Bung. 22 (1873). *Ornithopteris aquilina* (L.) J. Sm. Hist. Fil. 298 (1875). *Cincinalis lanuginosa* (Bory ex Willd.) Trevis. Atti Soc. Ital. sc. nat. **17:** 239 (1875). *Pteris gracilis* Paterson in Hennedy, Clydesd. Fl. Mem. Ed. 255 (1878). *Pteridium aquilinum* (L.) Kuhn var. *lanuginosum* (Bory ex Willd.) Kuhn in v. d. Decken, Reisen in Ost-Afrika **3**[3]**:** 11 (1879). *Pteris aquilina* L. var. *abbreviata* Gillot, Bull. Soc. Bot. France **29:** June, xxii (1882). *Pteris abbreviata* (Gillot) Gerard, Bull. Soc. Bot. France **29:** June, xxii (1882). *Pteris aquilina* L. var. *transsilvanica* Schur, Enum. Pl. Transs. 841 (1885), nomen nudum. *Pteridium aquilinum* (L.) Kuhn var. *brevipes* (Tausch) Luerss. in Rabenh. Krypt. Fl. Ed. 2, **3:** 107 (1889). *Pteridium aquilinum* (L.) Kuhn var. *umbrosum* Luerss. in Rabenh. Krypt. Fl. Ed. 2, **3:** 107 (1889). *Pteris aquilina* L. var. *normalis* O. Ktze. Rev. Gen. **2:** 820 (1891). *Pteris aquilina* L. f. *lanuginosa* (Bory ex Willd.) O. Ktze. Rev. Gen. **2:** 820 (1891). *Pteridium aquilinum* (L.) Kuhn var. *osmundaceum* Christ, Beiträge Krypt. Schweiz **1**[2]**:** 54 (1900). *Pteridium aquilinum* (L.) Kuhn var. *capense* (Thunb.) Christ, Beiträge Krypt. Schweiz **1**[2]**:** 55 (1900). *Pteridium capense* (Thunb.) Krasser in Zahlbruckner, Ann. Nat. Hofm. Wien, **15**[1]**:** 4 (1900). *Pteridium lanuginosum* (Bory ex Willd.) Clute, Fern Bull. **8:** 38 (1900), as to name-bringing synonym, not as to plant. *Pteridium ceheginense* Barnola, Bol. Soc. Aragonesa Cienc. Nat. **11:** 35 (1912). *Pteridium aquilinum* (L.) Kuhn var. *crispulatum* Barnola, Bol. Soc. Aragonesa Cienc. Nat. **11:** 35 (1912). *Pteridium aquilinum* (L.) Kuhn ssp. *capense* (Thunb.) Bonap. Notes Ptérid. **2:** 66 (1915). *Filix aquilina* (L.) Woynar, Hedwigia **56:** 383 (1915). *Filix-foemina aquilina* (L.) Farwell, Am. Mid. Nat. **12:** 290 (1931).

In 1848 Moore published *Pteris aquilina* L. var. *vera* but he

did not base it on *Pteris aquilina* L. He described it as having the secondary pinnules pinnatifid, while the Fuchs plate, the type of *Pteris aquilina,* has the secondary pinnules entire (in fact the pinnules are only pinnatifid). In contrast to his var. *vera* he had var. *integerrima,* secondary pinnules entire. He apparently thought of var. *vera* as the more common and hence more "typical" phase and his description of it excludes the type of *Pteris aquilina.*

Kuntze published a *Pteris aquilina* L. var. *normalis* in 1891 but did not actually base it on *Pteris aquilina* L. and circumscribed it much more broadly than the typical variety in the present treatment. "U. St.: Oil City" includes var. *latiusculum* and "Hongkong" includes either var. *latiusculum* or var. *Wightianum.*

Because of the above objections to taking up either var. *vera* Moore or var. *normalis* O. Ktze., I am designating the typical variety as var. *typicum,* definitely based on the type of *Pteris aquilina* L.

Growing tip of the rhizome with a tuft of dark hairs; frond 0.4–4 m., usually about *1–1.5 m. high,* the taller fronds scandent, *vernation gleichenioid;* stipe longer or shorter than the blade; *blade* 2–20 dm., usually about *6–10 dm. long,* usually *ovate-triangular,* less often ovate or broadly triangular, *not ternate,* bipinnate-pinnatifid or tripinnate, less often tripinnate-pinnatifid, rarely quadripinnate-pinnatifid; *rachis* usually *moderately pubescent,* less often densely pubescent or subglabrous; *pinnae and pinnules short-acuminate to obtuse; pinnules* usually *nearly at right angles to the costa,* sometimes at an oblique angle; costules slightly to densely pubescent beneath and less so above; penultimate segments usually pinnatifid, less often pinnate or pinnate-pinnatifid; longest entire segment or part of a segment from three to six, usually about four, times as long as broad; *ultimate segments* usually *straight,* rarely subfalcate, *adnate or broadest at the base,* the upper surface usually glabrous or slightly pubescent, rarely moderately pubescent, the *margin glabrous or subglabrous,* rarely moderately pubescent, the *lower surface* usually *densely pubescent,* less often slightly pubescent, rarely glabrous or pubescent only on the midnerve; *fertile and sterile indusium ciliate* and sometimes also *pubescent* on the outer surface, the *fertile* usually *0.3 mm. or more wide,* the *sterile* usually *0.2 mm. or more wide,* the *fertile portion broader than the sterile* on the same segment, *or no broader.*

TYPE: Figure of *Filix femina* Fuchs, Hist. 596, misprinted 569 (1542). Linnaeus did not have a specimen of *Pteris aquilina* in his herbarium in 1753 and the only illustration cited by him is taken as the type.

TYPE LOCALITY: Europe.

I have not been able to separate the African Bracken from the European. Extreme specimens from Africa differ from the typical European plant (*Tidestrom* 13295, France) in having a densely pubescent, flexuous rachis and the fertile indusium no broader than the sterile on the same segment. However, these characters are not always correlated and they show no definite geographic segregation. Specimens with the rachis densely pubescent and flexuous have been seen from Mauritius, "Ex. Herb. Wm. Boott" (G) and Madagascar, Herb. Field Mus. no. 595745. Specimens from British East Africa, *E. Heller;* Natal, *Abraham* 28; Cape of Good Hope, U. S. Nat. Herb. no. 22419; St. Thomas, *Moller* 33 and Sierre Leone, *Johnston* 7 have the rachis densely pubescent but straight. Distributed over essentially the same area are specimens that have a straight glabrous rachis: Egyptian Sudan, *Lynes* 186; British East Africa, *Mearns* 1229; Kilimanjaro, *Abbott;* Madagascar, *Webb* (?) 113 (G); Bourbon, *Halsey* (U. S. Nat. Herb. no. 1285441); and Cape of Good Hope, *Sim* 1579. Most of the European and about half of the African specimens have the fertile indusium broader than the sterile on the same segment. Specimens from the Azores, Madeira and Canary Islands and from northernmost Africa are distinctly of the European type.

Shade forms often approach var. *latiusculum* in some characters: they may be almost completely glabrous (*Ziesché,* Herb. Field Mus. no. 764960; Prov. Westfalen (G); *Kaulfup,* Bavaria (US)) or only slightly pubescent with the sterile indusium considerably less ciliate than normally (*Ziesché,* Reisengebirge, Silesia; *Richter,* Hungary).

Intermediates between var. *typicum* and var. *latiusculum* are only slightly pubescent beneath except on the midnerve and have the fertile and sterile indusium only slightly ciliate. Such are Danzig, July 24, 1876, *Baenitz* (F); Pl. Scand. ex insula Gotlandia, June 16, 1894, *Johansson* (US); Plantae Goreanae, *Taquet* 2317 (US); and Hungary, Aug., 1893, *Marton* (F).

Some specimens, here referred to var. *latiusculum*, approach var. *typicum* in one or more characters. The sterile indusium may be slightly ciliate and the blade pubescent beneath between the margin and the midnerve and the blade ovate: Pl. Sibiricae Exsicc. 1288, Tomsk; *Honig*, Bavaria; near Berlin, 1844. In *A. O. Olson*, Vestrogothia, Sweden, Aug. 17, 1915 (F) the indusium is slightly pubescent.

Several minor variations have been named, some of which may be worthy of recognition as forms, but I do not feel justified in recognizing them in view of the limited amount of material I have seen and the lack of field experience. Some of the variations that have been described certainly do not deserve recognition. *Pteris aquilina* var. *abbreviata* Gillot, for instance, is a much stunted plant found growing under extremely unfavorable conditions, on rocks and bathed in a sulphurous vapor at 20° C. *Pteridium cchegineuse* Barnola is a young plant with abnormal leaf-cutting and *Pteris gracilis* Patterson is also a young plant.

Var. *typicum* differs from var. *latiusculum* in its gleichenioid rather than equal vernation, in having the undersurface of the segments densely pubescent rather than pubescent only on the midnerve, in the glabrous rather than pubescent margin of the segments and the ciliate rather than glabrous fertile and sterile indusium. Also the frond is considerably taller on the average and the blade is ovate to ovate-triangular and evenly pinnate rather than broadly triangular with the basal pinnae considerably longer and broader than the second pair. The pinnules are usually at right angles to the costa rather than at an oblique angle and the penultimate segments are usually evenly pinnatifid rather than pinnate or pinnate-pinnatifid.

The critical differences between var. *typicum* and vars. *Wightianum, pubescens* and *Feei*, with which it is also closely related are discused under those varieties. It is perhaps most closely related to var. *pubescens* of western North America—probably representing another example of the well-known relationship of the floras of western North America and Europe.

Var. *typicum* grows in open woods, in clearings, at the edge of woodlands, in thickets, in pastures, in abandoned fields, in grassy places, on open hillsides, in forests and in recently burned-

over areas. It is most common in dry places and in acid soils. It grows from sea-level to about 1800 m. in the Alps and to 3000 m. in the mountainous regions of Africa.

It ranges throughout Europe and all but the drier regions of Africa, and adjacent islands.

EURASIA.—SWEDEN: Helsingborg, July, 1862, *Suetberg* (Herb. Field. Mus. no. 335698). IRELAND: Holywood, Oct. 20, 1884, (G). GREAT BRITAIN: Snowdon (Wales), July 19, 1905, *Pease* 8031 (G); Isle of Man, Sept., 1895, *Underwood* (NY). NETHERLANDS: Haaksbergen, July 20, 1918, *Boetje van Ruyven* (Herb. Field Mus. no. 840219). GERMANY: Heidelberg, Sept. 19 (Herb. Field Mus. no. 756408); Münsterland, Prov. Westfalen, Aug. 19, 1905 (G); Zabtengebirge, Mittelberg, Silesia, Aug. 29, 1906, *Ziesché* (Herb. Field Mus. no. 764960); Reisengebirge, Silesia, July 20, 1903, *Ziesché* (G); Spandau, Brandenburg, Sept., 1880, *Ruhmer* (F. Schultz herb. norm. no. 975) (G, NY); Nürnberg, Bavaria, Aug. 26, 1902, *Kaulfup* (US). CZECHOSLOVAKIA: Aug., 1911, *Petrak* (Fl. Bohemiae et Moraviae exsicc. no. 603) (G). HUNGARY: Klausenberg, Aug. 16, 1901, *Richter* (G); Piliscaba, Sept., 1916, *Filarszky & Kümmerle* (Fl. Hung. exsicc. no. 431) (F, G, US); Orawicza, *Wierzbicki* (Herb. Field Mus. no. 47805). SWITZERLAND: *Wilazek* (G). FRANCE: Bures, Sept. 26, 1909, *Jeanpert* (Herb. Field Mus. no. 815531); Perignac, Charente, Sept. 4–11, 1893, *Guillon* (Mangier, Fl. selecta exsicc. no. 3395) (F); July 11, 1934, *Tidestrom* 13295 (F, G, US); May 9, 1935, *Tidestrom* 13509 (NY); Vicinity of Paris, June 28, 1911, *Jeanpert* (Herb. Field Mus. no. 815529). SPAIN: San Sebastian, *Barbour* (NY). PORTUGAL: Porto, 1891, *Buchtien* (U. S. Nat. Herb. no. 1095027). CORSICA: July 20, 1933, *Aellen* 1306 (F, US); June 17, 1933, *Aellen* 1316 (F, US). ITALY: Venetia, Nov. 10, 1907, *Fiori, Béguinot & Pampanini* (Fl. It. exsicc. no. 705) (G); Capri, Aug. 29, 1909, *Ware* (G, US); Near Rome, *Pisotta* 34 (F). GREECE: Olympia, April 27, 1906, *Pease* 9081 (G). TURKEY: Taurus Mts., Aug. 12, 1907, *Wankow* (NY); "Plantae Tauricae," *Wankow* (US). UNION OF SOVIET SOCIALIST REPUBLICS: Dist. of Chernomose (Black Sea), *Kousenetzoff* (G); Caucasus, Kuban Prov., May 9, 1907, *Busch & Klopotow* (G); Western Grusia, Caucasus, *Meffert* 20 and 910 (G).

AFRICA.—ALGERIA: Oran, May 9, 1935, *Faure* (U. S. Nat. Herb. no. 1674024, NY). MOROCCO: 1889, *T. Williams* 118 (US). AZORES: 1890, *Chute* (G); July 18, 1894, *Brown* 334 (G). MADEIRA: 1853–56, *Wright* (G); 1838–42 (U. S. South Pacific Exploring Expedition) (G). CANARY ISLANDS: Grand Canary, Feb., 1897, *Cooke* 107 (F, G, NY, US). SIERRA LEONE: Oct., 1875 (Herb. Field Mus. no. 69396); Freetown, April 8, 1882, *H. H.*

Johnston 7 (G). LIBERIA: Grand Bassa, *Dinklage* 1628 (G); along Dukwai River near Firestone Plantations, 1928, *G. P. Cooper* 21 (F, NY, US). CAMEROON: Jan., 1919, *Gocker* 133 (G). ST. THOMAS (Is.): 1885, *Moller* 33 (US). FRENCH EQUATORIAL AFRICA: Fernand Vaz, French Congo, 1917, *Aschemeier* 19 (US). UNION OF SOUTH AFRICA. CAPE OF GOOD HOPE: Vicinity of Cape Town (U. S. South Pacific Exploring Expedition) (U. S. Nat. Herb. no. 22419); King Williamstown, 1892, *Sim* 1579 (G). NATAL: Mapumulo, 1867–69, *Abraham* 28 (G, US); *Buchanan* 534d (US). TRANSVAAL: Bokfontein, Aug. 3, 1934, *Mogg* 4755 (US); Rustenburg, (District of) Rustenburg, Sept., 1910, *Collins* (Herb. Field Mus. no. 653635).—MADAGASCAR: 1897 (Herb. Field Mus. nos. 595715, 595725, 595745, U. S. Nat. Herb. nos. 1431040, 1431121); *Webb*(?) 113 (G). BOURBON: (Herb. Field Mus. no. 830986); *Halsey* (U. S. Nat. Herb. no. 1285441). MAURITIUS: 1867, *Pike* (U. S. Nat. Herb. no. 593158); (U. S. Nat. Herb. no. 516236). TANGANYIKA (GERMAN EAST AFRICA): Kilimanjaro, 1889–90, *Abbott* (U. S. Nat. Herb. nos. 22433, 22472); Ulugurus, Bunduki, Aug. 2, 1935, *Bruce* 96 (US). ZANZIBAR: Oct., 1873, *Hildebrandt* (NY). UGANDA: Mt. Debasien, Jan., 1936, *Eggeling* 2703 (G); Vicinity of Kigomma, Dec. 30, 1909, *Mearns* 2617 (US); Kikayo, *Dümmer* 551 (US). KENYA (BRITISH EAST AFRICA): Mau Range, July 27, 1923, *A. G. Curtis* 848 (G); Lake Naivasha, July 17 to Aug. 15, 1909, *Mearns* 929 (US); Wambugu, Sept. 13, 1909, *Mearns* 1229 (G, US); Mbololo, Nov. 7–11, 1911–12, *E. Heller* (U. S. Nat. Herb. no. 634399). EGYPTIAN SUDAN: Jebel Marra, Dafur, Dec., 1921, *Lynes* 186 (US). ABYSSINIA: 1842, *Schimper* 856 (US).

2. PTERIDIUM AQUILINUM var. **Wightianum** (Ag.), n. comb. PLATE 650, FIG. 1, PLATE 651, FIG. 3, MAP 2. Illustration: Bedd. Ferns S. India, t. 42 (1863).

Pteris revoluta Bl. Enum. Pl. Jav. 214 (1828). *Pteris excelsa* Bl. Enum. Pl. Jav. 213 (1828). *Pteris lanigera* Bl. Enum. Pl. Jav. 214 (1828). *Pteris densa* Wall. List no. 99 (1829), nomen nudum, isotype at US. *Pteris firma* Wall. List no. 100 (1829), nomen nudum. *Pteris terminalis* Wall. List no. 101 (1829), nomen nudum. *Pteris recurvata* Wall. List no. 113 (1829), nomen nudum; ex Ag. Rec. Pterid. 50 (1839), isotype at US. *Pteris Wightiana* Wall. List no. 2178 (1829), nomen nudum. *Allosorus recurvatus* (Wall.) Pr. Tent. Pterid. 154 (1836), nomen nudum. *Pteris recurvata* Wall. ex Ag. var. *Wightiana* Ag. Rec. Pterid. 50 (1839), as *Wigtiana*, epithet taken from *Pteris Wightiana* Wall. *Pteris villosa* Fée, Gen. Fil. Mém. Fam. Foug. **5:** 128 (1850–1852). *Cincinalis villosa* (Fée) Trevis. Atti Soc. Ital. sc. nat. **17:** 239 (1875). *Pteridium aquilinum* (L.) Kuhn

var. *osmundoides* Christ ex Léveillé, Bull. Acad. Geogr. Bot. **20:** no. 243, 9 (1910), nomen nudum. *Pteridium capense* (Thunb.) Krasser var. *densa* Nakai, Bot. Mag. Tokyo **39:** 109 (1925), epithet taken from *Pteris densa* Wall. *Pteridium revolutum* (Bl.) Nakai, Bot. Mag. Tokyo **39:** 109 (1925).

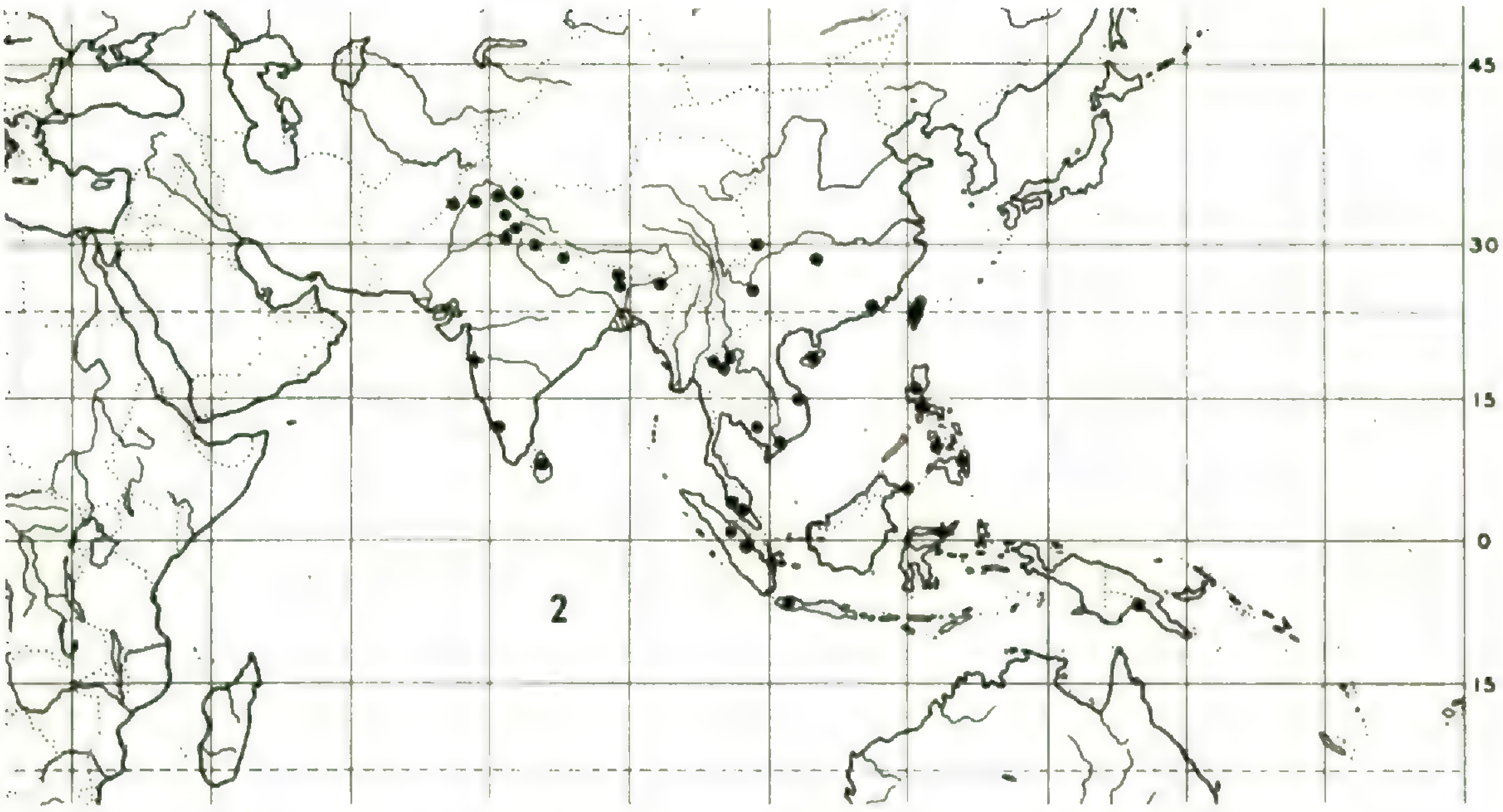
Growing tip of the rhizome with a tuft of dark hairs; *frond 0.6–4 m. high*, the taller fronds scandent, *vernation gleichenioid;* stipe usually shorter than the blade; *blade* 0.3–3 m., usually about *1.1–5 m. long, ovate-triangular,* or less often pentagonal, not ternate, usually tripinnate-pinnatifid, less often bipinnate-pinnatifid or tripinnate; *rachis* usually *densely or very densely pubescent*, rarely becoming subglabrous; *pinnae and pinnules* usually *long-acuminate*, infrequently short-acuminate; *pinnules* usually *nearly at right angles* to the costa, less often at a somewhat oblique angle; costules slightly to densely pubescent beneath and less so above; penultimate segments usually pinnatifid, less often pinnate or pinnate-pinnatifid; longest entire segment or part of a segment from three to seven, usually about four, times as long as broad; *ultimate segments* usually *falcate* or subfalcate, adnate or broadest at the base, the upper surface usually glabrous or slightly pubescent, the margin glabrous to moderately pubescent, the *lower surface* usually *densely pubescent,* less often slightly pubescent, rarely glabrous or pubescent only along the midnerve; *fertile and sterile indusium ciliate* and sometimes also *pubescent* on the outer surface, rarely glabrous, the *fertile* usually *0.3 mm. or less wide*, the *sterile* usually *0.2 mm. or less wide*, the *fertile portion no broader than the sterile* on the same segment.

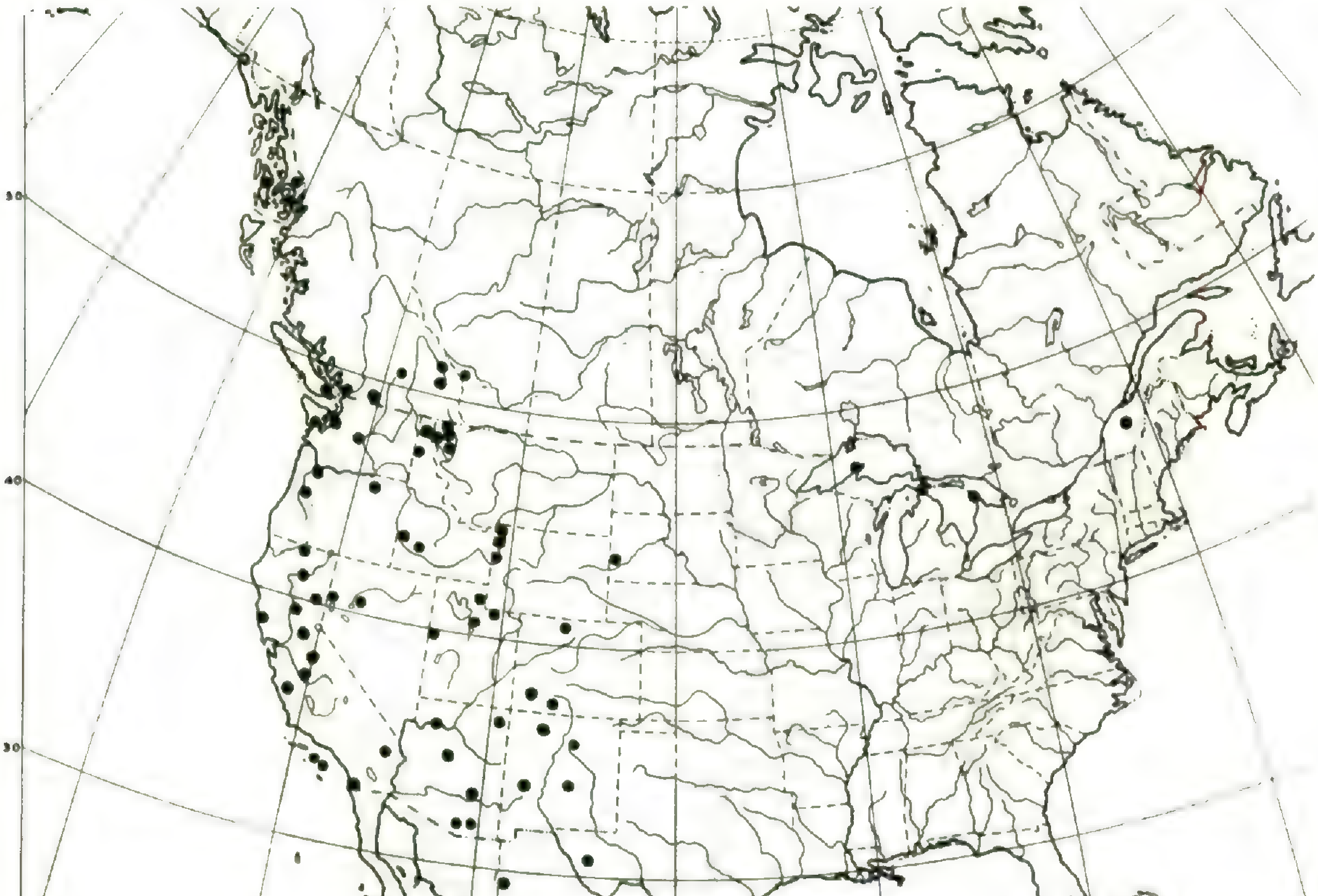
TYPE: *Wallich* **2178**, at Kew (not seen).

TYPE LOCALITY: Dindygul, India.

Specimens from the Himalayas (*R. R. & I. D. Stewart* 4761, 4048; *Stewart* 6492) are almost completely glabrous and *Stewart* 6492 has the ultimate segments narrowed at the base. However, they have the long-acuminate pinnae and pinnules of typical var. *Wightianum* and probably represent only a local variation. Other material from the same region is entirely typical. Some specimens approach var. *typicum* and var. *latiusculum* in having a nearly glabrous rachis (*Henry,* China; *Fang* 3281, China) or acuminate to obtuse pinnules (*Bartsch* 153, Philippine Is.; *Sallet*, Indo-China).

Var. *Wightianum* can be separated from var. *typicum,* with which it is apparently closely related, by its much more densely pubescent rachis, its long-acuminate rather than subacute or





Ranges of Pteridium aquilinum, var. Wightianum (map 2); var. pubescens (map 3).

obtuse pinnae and pinnules, its falcate rather than straight ultimate segments and the narrower fertile and sterile indusium. The critical differences between var. *Wightianum* and var. *latiusculum*, with which it intergrades, are discussed under that variety.

Var. *Wightianum* grows on dry hillsides, in jungle clearings, on waste slopes, on craters and in grassland, usually in sterile, often dry, soil. It occurs from 700 m. to 3300 m. in India and up to 2500 m. in China and 2800 m. in Papua.

It ranges from northwesternmost India east to Formosa, south to Ceylon, Java and British New Guinea.

India: N. W. India, 1871, *J. L. Stewart* 3626 (NY); Nazara, N. W. Himalayas, May 16, 1896 (US Nat. Herb. no. 1274966); Simla Region, Simla, Sept. 18, 1883, *Blanford* (NY); Sonamarg, Kashmir, July 28, 1921, *R. R. Stewart* 6492 (NY, US); Tragbal, Kashmir, July 31, 1919, *R. R. & I. D. Stewart* 4761 (NY, US); Murree Hills, Changla Gali, Punjab, Sept. 12, 1918, *R. R. & I. D. Stewart* 4048 (NY, US); Halann, Kulu, Punjab, May 21, 1931, *Koelz* 1980 (US); Kumaon, *Strachey & Winterbottom* 8 (G); Dalhousie, Punjab, June 9, 1917, *R. R. & I. D. Stewart* 2182 (NY, US); Nepal, 1820, *Wallich* 113 (US), isotype of *Pteris recurvata* Wall.; Khasi Hills, Shillong, Assam, Sept., 1888, *Mann* (NY, US); Sikkim, *Hooker* (G); Nilghiri, *Thomson* (G); 40 miles north of Darjeeling, Dec., 1884, *native collector* (NY). Ceylon: *Beckett* 182 (G); (U. S. Nat. Herb. no. 816885); (U. S. Nat. Herb. no. 22423); *G. Wall* (NY). Siam: Doi Sutep, Dec. 15, 1928, *H. M. Smith* 410 (G, US); Doi Chang Mt. near Hue San, Chiengmai Prov., Jan. 10, 1922, *Rock* 1720 (NY, US); Jan Khien, Doi Sootep, Chiengmai, Aug. 14, 1931, *Cunniff* 7 (NY). French Indo-China: Annam, Massif de Bah-Na, 30 miles southwest of Tourane, Aug., 1920, *Sallet* (G, NY, US); Cochinchina, May, 1870, *Pierre* 5793 (US); Angkor, Cambodia, Jan. 14, 1926, *H. M. Smith* 295 (US). Federated Malay States: Perak, 1887, *Wray* 1486 (US); Penang, 1822, *Wallich* 99 (US), isotype of *Pteris densa* Wall.; Pulan Tulai, Pahang, May 27, 1927, *Henderson* 18525 (US). China. Kwangtung: Canton and vicinity, Nov. 11, 1917, *Levine* 1834 (G). Hainan: Hainan, Dec. 18, 1933, *Wang* 35562 (NY). Kweichow: Kyingtenshan, Tsunyi, Jan. 3, 1930, *Tsiang* 5241 (G, NY); Liang Feng Yah, Tsunyi Hsien, July 31, 1931, *Steward, Chiao & Cheo* 53 (F, NY, US). Yunnan: Between Mohei and Moakai, March 20–April 7, 1922, *Rock* 2906 (G). Szechuan: Mt. Omei, Omei Hsien, 1928, *Fang* 3281 (G); Patung District, Feb., 1887, *Henry* (G).—Formosa: Arisan, Dec. 4, 1933, *Kanehira* 2995 (NY, US); Shakko,

Dec., 1913, *Faurie* (E. Rosenstock exsicc. no. 51) (G); Mt. Taihei, Taiheisan, Sept. 28, 1926, *Bartlett* 6034 (US).

PHILIPPINE ISLANDS: Dumaguete, Island of Negros, Prov. Negros Oriental, June, 1908, *Elmer* 10349 (G, NY, US); Port of Dos Amigos, Twai Twai Island, Feb. 19, 1908, *Bartsch* 153 (G, NY, US); Twin Peaks, Benguet Road, Luzon, March 2, 1908, *Bartsch* 210 (G, NY, US); Bosoboso, Prov. Rizal, Luzon, June, 1896, *Ramos* (Herb. Phil. Bureau Sci. no. 1054) (US); Bukidnon, Mindanao, July–Aug., 1913, *Escritor* (Herb. Phil. Bureau Sci. no. 21414) (US). BORNEO: *Korthals* (NY). SUMATRA: Aels Kanopan, Loendoet Concession, Koealoe, March 19, 1927, *Bartlett* 6993 (US); Toba, *Ouwchand* 204 (G). JAVA: Tjiboeroem, Preanger Prov., April 12, 1909, *Palmer & Bryant* 171 (US); vicinity of Goenoeng Boender, Batavia Prov., May 16, 1909, *Palmer & Bryant* 529 and 541 (US). PAPUA (BRITISH NEW GUINEA): Murray Pass, Wharton Range, Central Division, June–Sept., 1933, *Brass* 4634 (G, NY).

3. PTERIDIUM AQUILINUM var. PUBESCENS Underw. Our Nat. Ferns, Ed. 6, 91 (1900). PLATE 650, FIG. 3, PLATE 652, FIG. 5, MAP 3. Illustration: Ashton, Pl. Rocky Mt. Nat. Pk. 22 (1933), *habitat*.

Pteris aquilina L. var. *lanuginosa* Bong. Mém. Acad. St. Petersb. s. 6, **2:** 176 (1832), isotype at G. *Pteridium lanuginosum* (Bory ex Willd.) Clute, Fern Bull. **8:** 38 (1900), as to plant, not *Pteris lanuginosa* Bory ex Willd.; nomen provisorium. *Pteris lanuginosa* sensu Clute, Fern Bull. **8:** 37 (1900), not Bory ex Willd. *Pteris aquilina pubescens* (Underw.) Clute, Fern Bull. **15:** 124 (1907). *Pteridium latiusculum* (Desv.) Hieron. ex Fries var. *pubescens* (Underw.) [combination incorrectly attributed to Underw. by] Seymour, Host Ind. 25 (1929). *Filix-foemina aquilina* (L.) Farwell var. *lanuginosa* (Bong.) Farwell, Am. Mid. Nat. **12:** 290 (1931). *Pteris aquilina* L. var. *pubescens* (Underw.) [combination apparently incorrectly attributed to O. Ktze. by] Hanna, Am. F. Journ. **22:** 6 (1932). *Pteridium aquilinum* (L.) Kuhn var. *lanuginosum* (Bong.) Fernald, Rhodora **37:** 247 (1935), not (Bory ex Willd.) Kuhn (1879).

Growing tip of the rhizome usually *with a tuft of dark hairs; frond* 0.3–5 m., usually about *0.8–2 m. high*, the taller fronds scandent, *vernation subgleichenioid;* stipe usually shorter than the blade; *blade* 0.2–4 m., usually about *0.6–1 m. long*, usually *ovate-triangular*, less often pentagonal or ovate, *not ternate*, usually tripinnate or tripinnate-pinnatifid; rachis slightly to moderately pubescent; pinnae and pinnules subacute to obtuse; *pinnules* usually nearly or quite *at right angles to the costa*, sometimes somewhat at an oblique angle; costules usually slightly

FIG. 1, middle pinna of PTERIDIUM AQUILINUM, var. FEEI, × ½; FIG. 2, upper pinna of var. DECOMPOSITUM, × ½; FIG. 3, tip of middle pinna of var. WIGHTIANUM, × ⅓; FIG. 4, upper half of middle pinna of var. TYPICUM, × ½.

FIG. 1, basal pinna of PTERIDIUM AQUILINUM, var. LATIUSCULUM, × 1/3; FIG. 2, basal pinna of var. PSEUDOCAUDATUM, × 1/2; FIG. 3, next to basal pinnule of a basal pinna of var. AFRICANUM, × 1/2; FIG. 4, frond of variant of var. LATIUSCULUM, × 1/6; FIG. 5, next to basal pinna of var. PUBESCENS, × 1/3.

to moderately pubescent beneath and less so above; penultimate segments often pinnatifid, less often pinnate or pinnate-pinnatifid; longest entire segment or entire part of a segment from three to five, usually about four, times as long as broad; *ultimate segments* usually straight, adnate or broadest at the base, the *upper surface* slightly to quite *pubescent*, at least near the margin, the midnerve usually glabrous, the *margin moderately pubescent*, the *lower surface* usually *densely pubescent*, less often slightly pubescent, rarely glabrous except along the midnerve; *fertile indusium* usually slightly *ciliate* and slightly *pubescent* on the outer surface, rarely becoming glabrous with age, *sterile indusium ciliate* and sometimes also pubescent on the outer surface, the *fertile* usually *0.25–0.3 mm. wide*, rarely up to 0.5 mm. wide, the *sterile 0.25 mm. or less wide*, very rarely 0.4–0.5 mm. wide, the *fertile portion broader than the sterile* on the same segment.

TYPE: No type designated, specimens labeled by Underwood in the Herbarium of the New York Botanical Garden typify the variety.

TYPE LOCALITY: "Utah, California and northward."

Shade forms[15] approach var. *latiusculum* in having the sterile indusium glabrous or nearly so and the lower surface of the blade nearly glabrous, or in some cases more glabrous than in typical var. *latiusculum*—for example, *Merrill & Wilcox* 923, Wyoming; *Nelson & Nelson* 6733, Wyoming.

Intermediates between var. *pubescens* and var. *latiusculum* occur along the eastern border of the range of var. *pubescens*. Hanna[16] remarked that the Wyoming Bracken was "rather intermediate between the eastern *P. aquilina* [var. *latiusculum*] and the western *P. aquilina*, var. *pubescens* (Underw.) Kuntze." In a more recent article, on the ferns of Colorado where var. *latiusculum* also occurs, Wherry[17] says that "The relations be-

[15] In regard to ecological variation I think it is worthwhile to put on record the results of the following experiment. As part of the Carnegie Institution transplant experiments, the late Prof. Hall sent two plants of var. *pubescens* from Mather, California, to Mr. C. A. Weatherby at East Hartford, Connecticut. Mr. Weatherby received the plants in September, 1922, grew them successfully, and had them under observation until July, 1929. One plant was grown next to an unprotected east wall and the other by a fence, exposed to the sun for the greater part of the day. The reactions of the two plants were similar. The outline of the blade did not change and the segments did not become noticeably broader or thinner. The fronds grew to be six feet tall and dependent upon a support to remain erect. The only marked change was that the density of the pubescence gradually decreased so that in 1929 the plants were very noticeably less pubescent than when first received. The general differences between the Connecticut and California localities are a more humid climate, a lower elevation and about a four-degree higher latitude at the former.

[16] Hanna, Distribution of the Ferns of Wyoming. Am. F. Journ. **22**: 6 (1932).

[17] Wherry, Colorado Ferns. Am. F. Journ. **28**: 136 (1938).

tween these two Brackens need further study, for their intergradation in this region is so marked as to cast doubt on their specific distinctness." Some of the intermediates have the general characters of var. *latiusculum* except that they are pubescent beneath or have the pinnules set nearly at right angles to the costa. Others have an ovate blade and the sterile indusium slightly ciliate as in var. *pubescens* but are glabrous beneath except along the midnerve; or have the general characters of var. *pubescens* but have the pinnules at an oblique angle to the costa. Intermediate specimens are: Miller's Canyon, Huachuca Mts., Arizona, July 10, 1909, *Goodding* 170 (G, NY); San Francisco Mts., Arizona, Aug. 17, 1889, *Knowlton* 14 (G, US); Buckskin Mts., Arizona, June 30, 1909, *Tidestrom* 2336 (US); Central, New Mexico, Aug., 1895, *Mulford* 398 (NY); Rindoso Creek, Lincoln Co., New Mexico, July 1, 1895, *Mearns* (US); Buffalo Pass, Colorado, Aug. 11, 1898, *Shear & Bessey* (US); Southwest of Franktown, Douglas Co., Colorado, June 17, 1937, *Wherry* (US); Silver Reef, Utah, May 5, 1894, *M. E. Jones* 5176 (US); Gibbon Canyon National Park, Wyoming, *Carleton* 204 (F); Centennial Valley, Wyoming, Aug. 18, 1896, *Nelson* 2662 (NY).

Some specimens of var. *latiusculum* approach var. *pubescens* in characters of indusium and vestiture. A specimen from a burnt-over hillside, *Moore* 2221, West Virginia, is pubescent beneath between the margin and the midnerve and the fertile and sterile indusium is slightly ciliate and pubescent. The following specimens from New York, Ohio, Massachusetts and Indiana are pubescent beneath between the margin and the midnerve: Washington Co., New York, July 30, 1890, *Burnham* (Herb. Cornell U.)[18]; Otsego Co., New York, *Frost* (Herb. Cornell U.); Cleveland, Ohio, Aug. 15, 1875 (Herb. Cornell U.); Line Station, Indiana, Aug. 2, 1876, *Grassly* (F); Granville, Hampden Co., Massachusetts, Sept. 19, 1913, *Seymour* 60 (G).

An interesting phase, approaching var. *pubescens* in outline of blade and pubescence is discussed under var. *latiusculum*.

Var. *pubescens* differs from var. *latiusculum* in having the tip of the rhizome with a tuft of dark hairs rather than nearly

[18] I am indebted to Dr. R. T. Clausen for bringing to my attention this material in the Cornell University Herbarium.

naked, and an ovate-triangular, fairly evenly pinnate blade rather than a broadly triangular, ternate blade. Also the pinnules are nearly at right angles to the costa rather than at an oblique angle, the lower surface is densely pubescent between the margin and the midnerve rather than pubescent only on the midnerve and the fertile and sterile indusium is ciliate and sometimes also pubescent rather than glabrous. The frond is a little taller on the average and certainly reaches an extreme that var. *latiusculum* never approaches.

Var. *pubescens* differs from var. *typicum* in the pubescent rather than usually glabrous margin of the segments and the markedly less ciliate and pubescent fertile and sterile indusium. The penultimate segments are usually not as evenly pinnatifid or pinnate.

Var. *pubescens* is also closely related to vars. *Feei* and *decompositum* and the differences are discussed under those varieties.

In Michigan, Ontario and Quebec var. *pubescens* probably occurs as a pre-glacial relic on or related to local nunatak areas.[19]

Var. *pubescens* grows in pastures, open forests, burnt-over areas, on open slopes, in thickets, and in woods, in damp or dry places; mostly in the Transition and Canadian Zones, from sea level up to 3000 m.

It ranges from southern Alaska to Mexico, east to Wyoming, Colorado and western Texas; isolated eastward in South Dakota, northern Michigan, Bruce Co., Ontario and Megantic Co., Quebec.

ALASKA: New Metlapatla, July 5, 1895 (Herb. Field Mus. nos. 366780, 366786); Sitka, *Bongard* (G), isotype of *Pteris aquilina* var. *lanuginosa* Bong.; Sitka, Aug. 2, 1916, *J. P. Anderson* 263 (US); Heyder, June 25, 1924, *Whited* 1284 (US); McDonald Lake, July 15, 1921, *H. M. Smith* (US); Petersburg, July 3, 1918, *J. P. Anderson* 652 (NY).

DOMINION OF CANADA.—QUEBEC: Caribou Hill, Black Lake, Megantic Co., Aug. 26, 1915, *Fernald & Jackson* 11960 and 11961 (G). ONTARIO: Tobermory, Bruce Peninsula, July 28, 1933, *Krotkov* 6319 (US); Dunk's Bay, Tobermory, Bruce Co., Aug. 20, 1933, *T. M. C. Taylor* 6100 (G). ALBERTA: Vicinity of Banff, Aug. 29, 1899, *McCalla* 2434 (NY). BRITISH COLUM-

[19] See Fernald, Critical Plants of the Upper Great Lake Region of Ontario and Michigan. Rhodora 37: 247 (1935).

BIA: Tulameen River, 1900, *Kemp* (NY); Revelstoke, Selkirks, July 3, 1905, *Shaw* 786 (G, NY, US); Near Victoria, Vancouver Island, July 28, 1908, *Macoun* 84096 (F).

UNITED STATES OF AMERICA.—MICHIGAN: Lake Manganese, 1 mile southeast of Copper Harbor, Keweenaw Co., July 23, 1936, *Hermann* 8231 (US); West Bluff, 3½ miles west of Copper Harbor, Keweenaw Co., June 18, 1936, *Hermann* 7520 (NY); West Bluff, Keweenaw Co., July 4, 1934, *Fernald & Pease* 3033 (G, NY); Mackinac Island, July 28–29, 1898, *Millspaugh* 85 (F, G). SOUTH DAKOTA: (undoubtedly from the Black Hills) *Gifford* (G). TEXAS: Mt. Livermore, Davis Mts., Jeff Davis Co., Oct. 6, 1926, *E. J. Palmer* 32010 (G). MONTANA: Near Apgar, Glacier National Park, July 30, 1937, *T. G. & E. C. Yuncker* 7006 (F); Belton, Aug. 22, 1903, *Umbach* 732 (F, NY, US). IDAHO: Trinity, Elmore Co., Aug. 13, 1910, *Macbride* 599 (F, G, NY, US); Lake Pend Oreille, Kootenai Co., Aug. 23, 1892, *Sandberg, MacDougal & Heller* 943 (US). WYOMING: Gibbon Canyon, Yellowstone National Park, Aug. 28, 1899, *E. & A. Nelson* 6733 (G, NY, US); Leigh's Lake, July 24, 1901, *Merrill & Wilcox* 923 (G, NY, US); Alpine, Lincoln Co., July 13, 1923, *Payson & Armstrong* 3486 (G); Bradley Creek, Grand Teton National Park, July 17, 1932, *L. Williams* 887 (G, NY). COLORADO: Near Pagosa Peak, Aug. 25, 1899, *C. F. Baker* 128 (G, NY, US); Park Range above Steamboat Spa, Aug. 11, 1898, *Shear & Bessey* (NY). UTAH: La Motte Peak, July 24, 1926, *E. B. & L. B. Payson* 5078 (G); Granite Canyon, Deep Creek Mts., Juab Co., June 20, 1933, *Maguire & Becraft* 2466 (G). NEVADA: East Humboldt Mts., Aug., 1868, *Watson* 1359 (G); Little Valley, Washoe Co., Aug. 14, 1902, *C. F. Baker* 1460 (G, NY, US). NEW MEXICO: Jemez Canyon, Aug. 10, 1932, *A. & R. A. Nelson* 212 (G); Sacramento Mts., Lincoln Co., July 30, 1923, *Eggleston* 18881 (NY). ARIZONA: Chiricahua Mts., Barefoot Park, Oct. 19, 1906, *Blumer* 1450 (F, G, NY, US); Washall Gulch, Santa Catalina Mts., Oct. 2, 1917, *Shreve* 5397 (F, G). CALIFORNIA: Avalon, Santa Catalina Island, Mar., 1897, *Trask* (US); Near Forest Ranch, Sierra Foothills, Butte Co., Sept. 23, 1916, *A. A. Heller* 12660 (F, G, NY, US); Plains of Mendocino, Aug. 10, 1882, *Pringle* (F, G, NY, US). OREGON: Portland, June 25, 1920, *Fisher* 14 (G); Salem, 1871, *E. Hall* 678 (F, G). WASHINGTON: Wenatchee, Chelan Co., July 6, 7, 1916, *Eggleston* 12930 (F); Seattle, King Co., Sept. 19, 1931, *J. W. Thompson* 8106 (G).

MEXICO.—BAJA CALIFORNIA: Sierra San Pedro Martir, 1923, *Gallegas* (US). CHIHUAHUA: Majalca, Aug. 20, 1935, *LeSuer* Mex-498 (F); Southwestern Chihuahua, Aug.–Nov., 1885, *E. Palmer* 447 (G, US); Madera, May 27–June 3, 1908, *E. Palmer* 288 (F, G, NY, US); Majarachic, April 24, 1938, *Knobloch*

5114 (F). DURANGO: Metates, north of Cueva, Aug. 29–30, 1934, *Pennell* 18410 (US).

(*To be Continued*)

WALKER PRIZE IN ECONOMIC BOTANY.—Original unpublished essays on any subject in the field of plants useful to man are eligible for the Walker Prize competition for 1941. Further information may be had from the Secretary, New England Museum of Natural History, 234 Berkeley Street, Boston, Massachusetts. The closing date is May 1, 1941.

THE RED AZALEA OF THE CUMBERLANDS

E. LUCY BRAUN

FOR a number of years the writer has been referring to an Azalea of the Cumberland Mountains and Cumberland Plateau under the name " red azalea,"[1] for want of something more specific. W. H. Camp also mentions " red azalea."[2] In Small's flora, the statement is made that " a red azalea native in the Cumberland Mountains . . . may be distinct."[3] To refer this plant to *Rhododendron calendulaceum* is to ignore its outstanding differences from that species. The red azalea of the Cumberlands is sufficiently different from *R. calendulaceum* as to be readily distinguished at any season. It also differs in habitat and in time of bloom from that species. *R. calendulaceum* in southeastern Kentucky blooms at the beginning of May. The natives there call it " honeysuckle " or " yellow honeysuckle." When the writer first saw bushes of the red azalea, in August, 1931, on the summit of Black Mountain in Harlan County, Ky., and inquired of a mountaineer as to the color and time of bloom, the reply was that the flowers are red and bloom in summer, about the first of July. They are not there confused with the " yellow honeysuckle." The height of the bloom-period is the end of June,

[1] Braun, E. Lucy, Vegetation of Pine Mountain, Kentucky. Amer. Midland Nat. **16**: 517–565. 1935. An ecological transect of Black Mountain, Kentucky. Ecol. Mon. **10**: 193–241. 1940.

[2] The red azalea of Black Mountain, Kentucky. Jour. N. Y. Bot. Garden **37**: 164–165. 1936.

[3] Small, J. K. Manual of the southeastern flora, p. 994. N. Y. 1933.

though in early seasons, bushes at lower elevations may bloom the middle of June. There is, then, an interval of five weeks to two months between the bloom-periods of these two azaleas.

The hesitancy in assigning specific rank to the red azalea has been due to its resemblance to the flame azaleas of the southern Blue Ridge and Great Smoky Mountains. The great range in time of bloom and in relative maturity of leaves at blossom-time which is displayed by flame azaleas of the southern Blue Ridge province, especially the Great Smoky Mountains, where there is a succession of bloom from May to July, suggest that all are referable to one species, or perhaps are hybrids. This last possibility is mentioned by Camp.[4]

In a region where the bloom-periods do *not* overlap, hybrids are impossible, and specific stability is maintained. In southeastern Kentucky (in Letcher County) both *R. calendulaceum* and red azalea occur. Specimens of the former were collected in full bloom on May 6, 1934, at an elevation of about 2700 ft. in Joe Day Branch, Black Mountain. The flowers open when the leaves are unfolding and when some are about half-grown, but before the leafy shoots of the season have elongated. On the same day, and at approximately the same elevation, specimens of red azalea were collected. The buds which produce the flower-clusters are still in winter condition. The winter buds which produce leafy shoots are just beginning to open. On June 21, 1933, (a very early season) specimens of the two azaleas were collected on Pine Mountain, Letcher County, Ky., at about 2000 ft. elevation. At that time, the capsules of *R. calendulaceum* were about half-grown, some 2 cm. long; the flowers of red azalea were just beginning to fade. These differences at the same date and elevation are mentioned in order to emphasize the improbability of hybridization in this region, hence the maintenance of specific distinctness of the two azaleas. In a region where only one of these azaleas occurs, a pure strain should persist.

At the western edge of the Cumberland Plateau in southern Kentucky, the red azalea occurs, but not the better known flame azalea. This is a region of isolated occurrences of ancient species, some coastal plain, some southern Appalachian.[5] The red azalea

[4] Camp, W. H. On Appalachian trails. Jour. N. Y. Bot. Garden, **37**: 249–265. 1936.
[5] Braun, E. Lucy. Some relationships of the flora of the Cumberland Plateau and Cum-

of this section may well represent an ancient species which here has remained distinct; hence a specimen from this area is designated as the type of *Rhododendron cumberlandense* to be described here. In the southern Blue Ridge province it has hybridized freely resulting in the apparently variable flame azalea of that section. A genetical study might help to establish the specific identity of the red azalea and the hybrid nature of the flame azalea of the southern Blue Ridge. *Rhododendron calendulaceum* of southeastern Kentucky and the red azalea of Kentucky both differ from flame azaleas collected on Standing Indian Mountain in the Nantahala National Forest of North Carolina on June 26, 1940. The flame azalea of the Nantahala region has characters of both of the Kentucky azaleas under consideration, and resembles the red azalea in the habit of flowering when the leaves are about mature.

In 1937, W. P. Lemmon described as *Azalea Bakeri* a yellow- to red-flowered species from northern Georgia.[6] The red azalea of the Cumberlands and Lemmon's species have some features in common, suggesting that perhaps *A. Bakeri* is by hybridization related to the red azalea (here designated as *R. cumberlandense*). It appears to be a much larger-flowered species.

RHODODENDRON **cumberlandense,** sp. nov. Shrub with twigs sparsely strigose, winter buds yellow-brown, scales ciliate, mucronate, the outer scales aristate. Leaves obovate, 3–5 cm. long, glabrous except on midrib above and midrib and lateral veins below, margin ciliate. Flowers opening 5–6 weeks after leaves, mostly red; corolla 3.5–4 (rarely 5) cm. broad; upper lobe broad, with large orange blotch. Filaments carmine, nearly glabrous. Capsule 2 cm. long, strigose.[7]—Cumberland Plateau and Cumberland Mountains, Kentucky, in mesophytic oak woods. Type (in writer's herbarium) and isotype (in herbarium of Arnold Arboretum), Yahoo ridge, McCreary Co., Ky., June 15, 1935 (*Braun*,

berland Mountains in Kentucky. Rhodora **39**: 193–208. 1937. A remarkable colony of coastal plain plants on the Cumberland Plateau in Laurel County, Kentucky. Am. Midland Nat. **18**: 363–366. 1937.

[6] Lemmon, W. P. Notes on a study of the southeastern azaleas with descriptions of two new species. Bartonia, no. **19**: 14–17. 1937.

[7] RHODODENDRON **cumberlandense**, sp. nov., frutex, ramulis sparse strigosis, gemmis flavobrunneis, paleis ciliatis mucronatis, exterioribus aristatis; foliis obovatis 3–5 cm. longis, costa supra costa venulisque lateralibus infra exceptis glabris, margine ciliatis; floribus 35–40 diebus post maturitate foliorum dehiscentibus; corollis 3.5–4 (rarius –5) cm. latis, lobo superiore lato, macula magna aurantiaca ornato; filamentis rubris fere glabris; capsulis 2 cm. longis. Typus (in herb. scriptoris) ad Yahoo Ridge, Comitate McCreary, Kentucky, June 15, 1935, collectus, *Braun* 971.

no. 971). Specimens in writer's herbarium from Flat Rock, McCreary Co.; 10 miles east of London, Laurel Co.; Peabody, Clay Co.; Stony Fork of Leatherwood, Perry Co.; Buck Branch, Whitley Co.; Pine Mountain, Letcher Co.; Black Mountain, Letcher Co. Most abundant on the summit of Black Mountain in Letcher and Harlan counties; also on Log Mountain in Bell Co.

A tabular comparison of the characters of *R. calendulaceum* (the early spring blooming plant of the Cumberland Mts., not the apparent hybrids of the southern Blue Ridge) and of *R. cumberlandense* will emphasize the characters of the latter species.

R. calendulaceum	*R. cumberlandense*
A shrub of dry southerly slopes, growing in company with other heaths.	A shrub of more mesophytic (usually oak) woods, often the only heath.
Loosely branched, straggly; leaves more or less evenly disposed along the twigs of the season.	More compactly branched; leaves more crowded toward tips of twigs.
Young twigs and petioles strigose, with dense fine pubescence between the coarse hairs.	Young twigs sparsely strigose, otherwise glabrous or nearly so.
Young winter buds (June) yellow, scales ciliate, the outer scales pubescent, mucronate.	Young winter buds (June) yellow-brown, glabrous, scales ciliate, mucronate, the outer aristate, outermost with awn as long as body of scale.
Leaves bright green, 5–7 cm. long, 2.5–3 cm. wide, broadest in the middle or sometimes above, sparsely strigose above and below, densely so near the leaf margins and on veins beneath; midrib beneath with dense fine pubescence between the coarse hairs.	Leaves dark green, mostly 3–5 cm. long, occasionally 7 cm., 1.5–2 or sometimes 2.5 cm. wide, broadest above the middle; glabrous above except for short fine whitish pubescence along the midrib, glabrous below except on midrib and larger lateral veins which are finely pubescent and sparsely strigose; margins ciliate, but without the strigose band near margin.
Flowers opening with the leaves.	Flowers opening 5–6 weeks after the leaves, i.e., when leaves are about mature.
Corolla 5 cm. or more across, yellow to orange; the upper corolla-lobe broader than the lateral.	Corolla 3.5–4 cm. or sometimes 5 cm. across, prevailingly red, but ranging through all the nasturtium colors; the upper corolla-lobe broader than laterals, sometimes 2×, almost orbicular but contracted to a short acuminate tip, with an orange-yellow blotch occupying most of the area.

R. calendulaceum	*R. cumberlandense*
Corolla-tube loosely and coarsely glandular-pubescent, scattered glandular hairs continuing in a band almost to the apex of corolla-lobes in the midrib region.	Corolla-tube pubescent with short glandular and non-glandular hairs, the glands, almost sessile, continuing in a band almost to apex of corolla lobes.
Style and filaments orange shading to yellow about half-way to tip.	Style and filaments carmine.
Filaments conspicuously pubescent for 1–2 cm. beyond throat of corolla tube.	Filaments glabrous or sparsely pubescent for about 1 cm. beyond throat of corolla tube.
Calyx-lobes short-ovate, sparsely hirsute, ciliate.	Calyx-lobes similar.
Capsules narrowly elongate, 2.5 cm. long, strigose, with pedicels glandular-pubescent.	Capsules broader and shorter, 2 cm. long, strigose, with pedicels strigose.

The smaller and more brilliantly colored flowers, the summer blooming even at low elevations (1200–1300 ft. at the western edge of the Cumberland Plateau), the small, nearly glabrous leaves, and brown, glabrous winter-buds with awned scales will generally distinguish this azalea from *R. calendulaceum.*

The University of Cincinnati,
Cincinnati, Ohio.

Geranium nemorale Suksd., var. **Bicknellii** (Britton), comb. nov. *G. Bicknellii* Britton in Bull. Torr. Bot. Cl. xxiv. 92 (1897).

When I published a study of *Geranium carolinianum and Allies in northeastern North America*, in Rhodora, xxxvii. 295–301 (1935), I was guilty of a lapse, due to long familiarity with the name *G. Bicknellii.* I there showed that there are no specific distinctions but good varietal characters separating the more eastern plant (*G. Bicknellii*) from the more western *G. Bicknellii,* var. *longipes* (Wats.) Fern. in Rhodora, l. c. 297 (1935). Under var. *longipes* I included as a synonym *G. nemorale* Suksd. in Deuts. Bot. Monats. xvi. 222 (1892), being then quite blind to the fact that Suksdorf's binomial antedated that of Britton by five years! My attention was most kindly directed to this error a year ago by Mr. S. J. Smith, who suggested that I make

the correction. Since the point was his discovery, I have urged that he clarify it; but, as he has modestly refrained from doing so in print, I am making the needed correction.—M. L. FERNALD.

LACHNANTHES IN NOVA SCOTIA.—In the course of some recent motoring in Nova Scotia, my wife and I traversed an area in Queen's County, northwest of Liverpool, which had not been visited either by the Gray Herbarium Expedition of 1920 or by Messrs. Fernald and Long in the following year.[1] Shortly before reaching it, we had chanced upon the station for *Lophiola* at Fancy Lake[2] and our appetite for collecting had been whetted thereby. Accordingly, we made stops, rather brief but as long as our schedule allowed, in a patch of red-oak woods, on a pebbly beach of Ponhook[3] Lake, and at another point on the same lake where the strand was composed of solidly compacted black peat, cut off so sharply at the water's edge as to form there a miniature cliff a foot or two high.

The woods yielded nothing of interest. The pebbly beach had *Aster Tradescanti* L. (*A. vimineus* var. *saxatilis* Fern.) somewhat farther east in Nova Scotia than recorded by Prof. Fernald. The peaty strand rewarded us with *Lachnanthes tinctoria* (Walt.) Ell., apparently new to Nova Scotia and to Canada. The nearest known stations are in southeastern Massachusetts.

This adds one more to the considerable list of coastal-plain species with similarly interrupted ranges known from Nova Scotia and suggests that Prof. Fernald's prophecy as to the increased proportion of such species in the flora of the province which further collection would reveal,[4] might easily be fulfilled.—C. A. WEATHERBY, Gray Herbarium.

[1] RHODORA, xxiii. 90ff. (1921); xxiv. 157ff. (1922).

[2] RHODORA, xxiv. 167.

[3] So spelled on the official highway map of Nova Scotia; "Penhook" in Rand-McNally's Atlas.

[4] RHODORA, xxiii. 168.

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H pl. 653

FIG. 1, upper half of middle pinna of PTERIDIUM AQUILINUM, var. ESCULENTUM, × ½; FIG. 2, basal pinna of small plant of var. YARRABENSE, × ½; FIG. 3, upper pinna of var. ARACHNOIDEUM, × ⅓; FIG. 4, tip of frond of var. CAUDATUM, × ½.

Rhodora

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THE NEW ENGLAND BOTANICAL CLUB

Vol. 43. February, 1941. No. 506.

A REVISION OF THE GENUS PTERIDIUM

R. M. Tryon, Jr.

(*Continued from page 31*)

4. Pteridium aquilinum var. Feei (Schaffn. ex Fée) Maxon ex Yuncker, Field Mus. Pub. Bot. **17:** no. 4, 308 (1938). Plate 650, fig. 4, plate 651, fig. 1, map 7.

Pteris aquilina L. var. *pubescens* Kze. Linnaea **13:** 142 (1839), as to plant, not as to basinym, *Pteris lanuginosa* Spreng. *Pteris aquilina* L. var. *pubescens* Spreng. ex Liebm. Vid. Selsk. Skr. s. 5, **1:** 225 (1849), as to plant, not as to basinym, *Pteris lanuginosa* Bory ex Willd. *Pteris Feei* Schaffn. ex Fée, Mém. Fam. Foug. **8:** 73 (1857). *Pteridium Feei* (Schaffn. ex Fée) [combination incorrectly attributed to Maxon by] Faull, Contrib. Arn. Arb. **11:** 87 (1938).

Pteris aquilina L. var. *pubescens* Spreng. ex Liebm. based on *Pteris lanuginosa* Bory ex Willd. and *Pteris aquilina* L. var. *pubescens* Kze. based on *Pteris lanuginosa* Spreng. are both earlier varietal names than var. *Feei*, and were originally applied to this variety, but their basinyms refer them, respectively, to var. *typicum* and var. *latiusculum*. Also, of course, they could not to be used under *Pteridium* because of var. *pubescens* Underw.

Growing tip of the rhizome with a tuft of dark hairs; *frond* 0.2–1 m., usually about *0.5–0.7 m. high, vernation subgleichenioid;* stipe usually shorter than the blade; *blade* 1–5 dm., usually *about 3 dm. long,* usually *broadly ovate or pentagonal,* less often ovate or broadly triangular, not ternate, usually bipinnate-pinnatifid to tripinnate, less often tripinnate-pinnatifid; *rachis* usually *slightly pubescent,* sometimes strongly pubescent or

glabrate; pinnae and pinnules short-acuminate to obtuse; pinnules usually nearly at right angles to the costa, sometimes at an oblique angle; costules slightly to moderately pubescent beneath and less so above; penultimate segments pinnatifid, often pinnate, or pinnate-pinnatifid; longest entire segment or entire part of a segment from three to eight, usually about four, times as long as broad; *ultimate segments* usually straight, rarely subfalcate, adnate or broadest at the base, the *upper surface* slightly to moderately *pubescent*, at least near the margin, the midnerve glabrous or slightly pubescent, the *margin* usually moderately *pubescent*, rarely glabrate, the lower surface usually densely pubescent, rarely slightly pubescent or pubescent only on the midnerve; *fertile and sterile indusium ciliate and* sometimes also *pubescent* on the outer surface, the *fertile* usually *0.3 mm. or more wide*, the *sterile* usually *0.4 mm. or more wide*, the *fertile portion no broader than the sterile* on the same segment.

Type: *Schaffner* 138, 141. Probably at Rio de Janeiro (not seen).

Type Locality: Huatusco, Mexico.

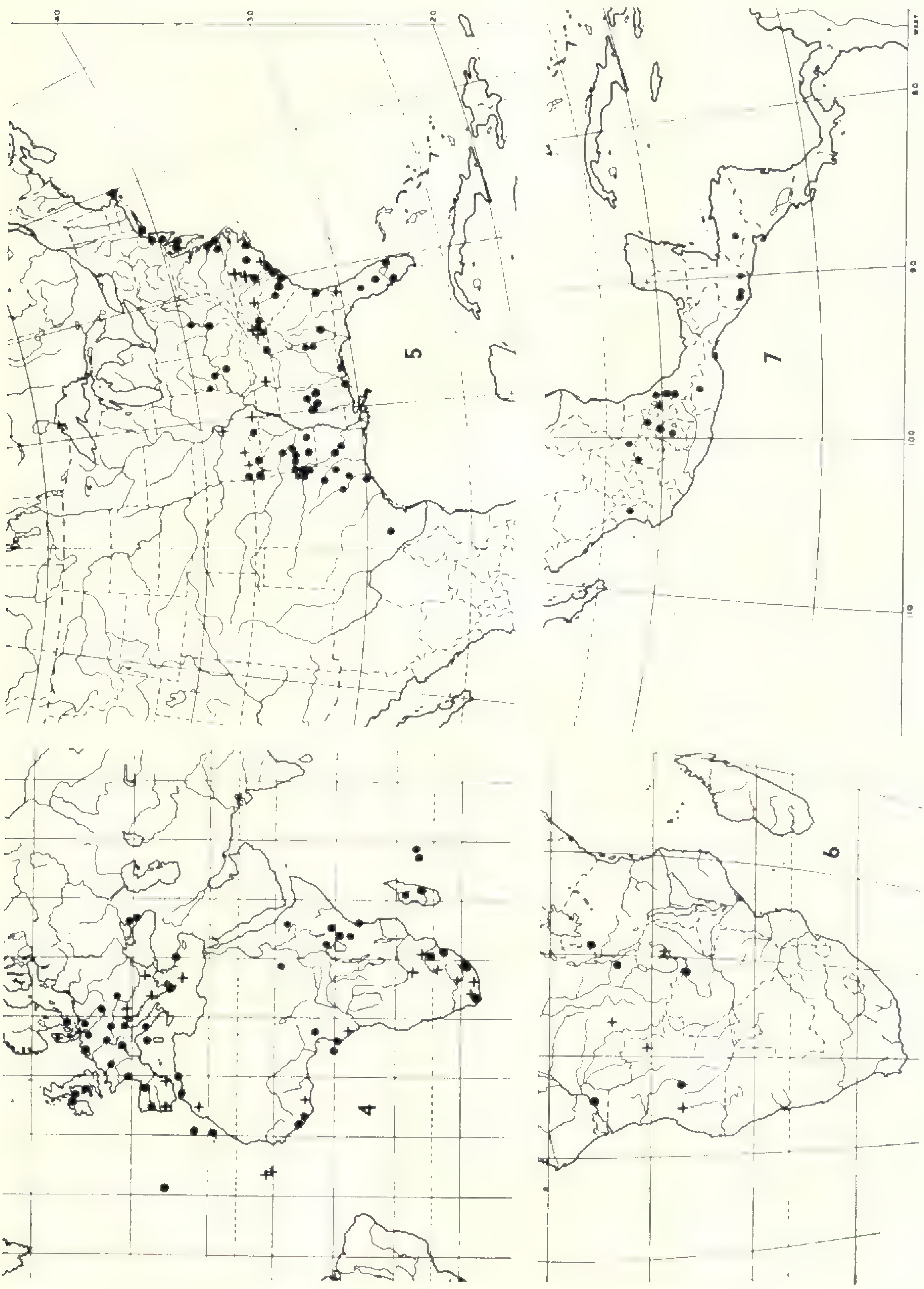
Some specimens of var. *Feei* are not entirely typical, having some character of var. *pubescens* : *Heyde & Lux* from Guatemala and *Mohr* from Vera Cruz, Mexico have the sterile indusium narrow, 0.2–0.3 mm. wide; *Rose* 2212, Tepic, Mexico has the sterile indusium only slightly ciliate; and *Palmer* 67, San Luis Potosí, Mexico has an ovate blade. *Ortega* 7400, Sinaloa, Mexico, 1934 (F) is intermediate between the two varieties.

Var. *Feei* may be separated from var. *pubescens* by its conspicuously ciliate rather than only slightly, if at all, ciliate fertile indusium, the usually much more ciliate sterile indusium, which is also almost twice as broad, and the fertile portion of the indusium no broader than the sterile on the same segment rather than broader. On the average, the fronds are considerably smaller.

It differs from var. *typicum* in having the margin of the segments pubescent rather than glabrous, the sterile indusium usually considerably broader, and in its usually smaller size. Its differences from var. *decompositum*, with which it is also closely related, are discussed under that variety.

Var. *Feei* grows in the mountains of Mexico, Guatemala and Honduras, up to 2800 m.

Mexico.—San Luis Potosi: San Miguelito Mts., 1876, *Schaffner* 925 (G); Alvarez, Sept. 5–10, 1902, *E. Palmer* 67 (F, G, NY,



Ranges of Pteridium aquilinum var. typicum (map 4); var. pseudocaudatum (map 5); var. africanum (map 6); var. Feei (map 7).

US). Terr. Tepic: near Santa Teresa, Aug. 12, 1897, *Rose* 2212 (G, NY, US). Guanajuato: 1905, *Duges* 6 (US). Hidalgo: Durango, Aug. 13, 1937, *Fisher* (NY, US); El Chico, July, 1927, *Lyonnet* 98 (G, NY); between Somoriel and Las Lajas, Aug. 5, 1905, *Rose, Painter & Rose* 9204 (NY, US). Vera Cruz: Huatusco, April, 1857, *Mohr* (U. S. Nat. Herb. no. 724103); Cordoba, 1889–91, *Fink* 18 (G, NY, US); near Jalapa, May 12, 1900, *Pringle* 8342 (US). Mexico: Oct., 1875, *Schaffner* 59 and 116 (NY); below Ajusco, Sept. 19, 1903, *Rose & Painter* 7214 (G, US). Puebla: Teziutlan, Sept. 7, 1910, *Orcutt* 4029 (US). Oaxaca: Cerro de San Felipe, Sept. 26, 1897, *Conzatti & Gonzales* 487 (G); Cuicatlan, June 16 and 22, 1898, *Conzatti & Gonzales* 747 (G, US).—Guatemala: Between Solola and Chiducadenango, Aug. 13, 1936, *Hatch & Wilson* 322 (US); Chichavac, Chimaltenango, Nov.–Dec., 1930, *Skutch* 12 (US); Laguna de Avarza, Jalapa, Sept., 1892, *Heyde & Lux* (J. D. Smith no. 4080) (G, NY, US). Honduras: Near Siguatepeque, Dept. Comayagua, July 3, 1936, *Yuncker, Dawson & Youse* 5600 (F, G, NY, US).

5. Pteridium aquilinum var. **decompositum** (Gaud.), n. comb. Plate 650, fig. 5, plate 651, fig. 2. Illustration: St. John & Hosaka, Weeds Pineapple Fields. Haw. Is., Univ. Haw. Res. Pub. **6, 24** (1932).

Pteris decomposita Gaud. in Freyc. Voy. Bot. 393 (1829). *Pteridium capense* (Thunb.) Krasser var. *decompositum* (Gaud.) Nakai, Bot. Mag. Tokyo **39:** 110 (1925).

Growing tip of the rhizome with a tuft of dark hairs; *frond* 0.5–2 m., usually about *0.7–1 m. high, vernation subgleichenioid;* stipe usually shorter than the blade; *blade* 2–10 dm., usually about *4 dm. long,* usually *ovate or broadly ovate,* not ternate, usually tripinnate or tripinnate-pinnatifid; *rachis glabrous* or slightly pubescent; pinnae and pinnules short-acuminate to obtuse; pinnules usually nearly at right angles to the costa, sometimes at an oblique angle; costules slightly pubescent beneath and less so above; penultimate segments pinnatifid, pinnate or pinnate-pinnatifid; longest entire segment or entire part of a segment from three to five, usually about four, times as long as broad; ultimate segments usually straight, adnate or broadest at the base, the *upper surface glabrous,* rarely very slightly pubescent along the midnerve, the margin glabrous, slightly pubescent, or rarely quite pubescent, the *lower surface* usually *densely subappressed-lanuginose pubescent,* sometimes only slightly so; *fertile and sterile indusium ciliate* and sometimes also *pubescent* on the outer surface, rarely becoming glabrous with age, the *fertile* usually about *0.3 mm. wide,* the *sterile*

usually about *0.2 mm. wide,* the *fertile portion broader than the sterile* on the same segment, *or no broader.*

TYPE: *Gaudichaud,* in Herb. Muséum d'Histoire Naturelle, Paris (not seen).

TYPE LOCALITY: Hawaiian Islands.

Var. *decompositum* is closely related to vars. *Feei* and *pubescens.* However, it has a nearly glabrous rachis rather than a pubescent one as in those two varieties and the upper surface of the segments is glabrous or rarely slightly pubescent only along the midnerve rather than pubescent and usually with a glabrous midnerve. The sterile indusium is only about half as broad as that of var. *Feei* and on the average it is not as large a plant as var. *pubescens.* The margin of the segments is sometimes glabrous or nearly so rather than pubescent. The sub-appressed pubescence on the lower surface of the segments is characteristic though not always well defined.

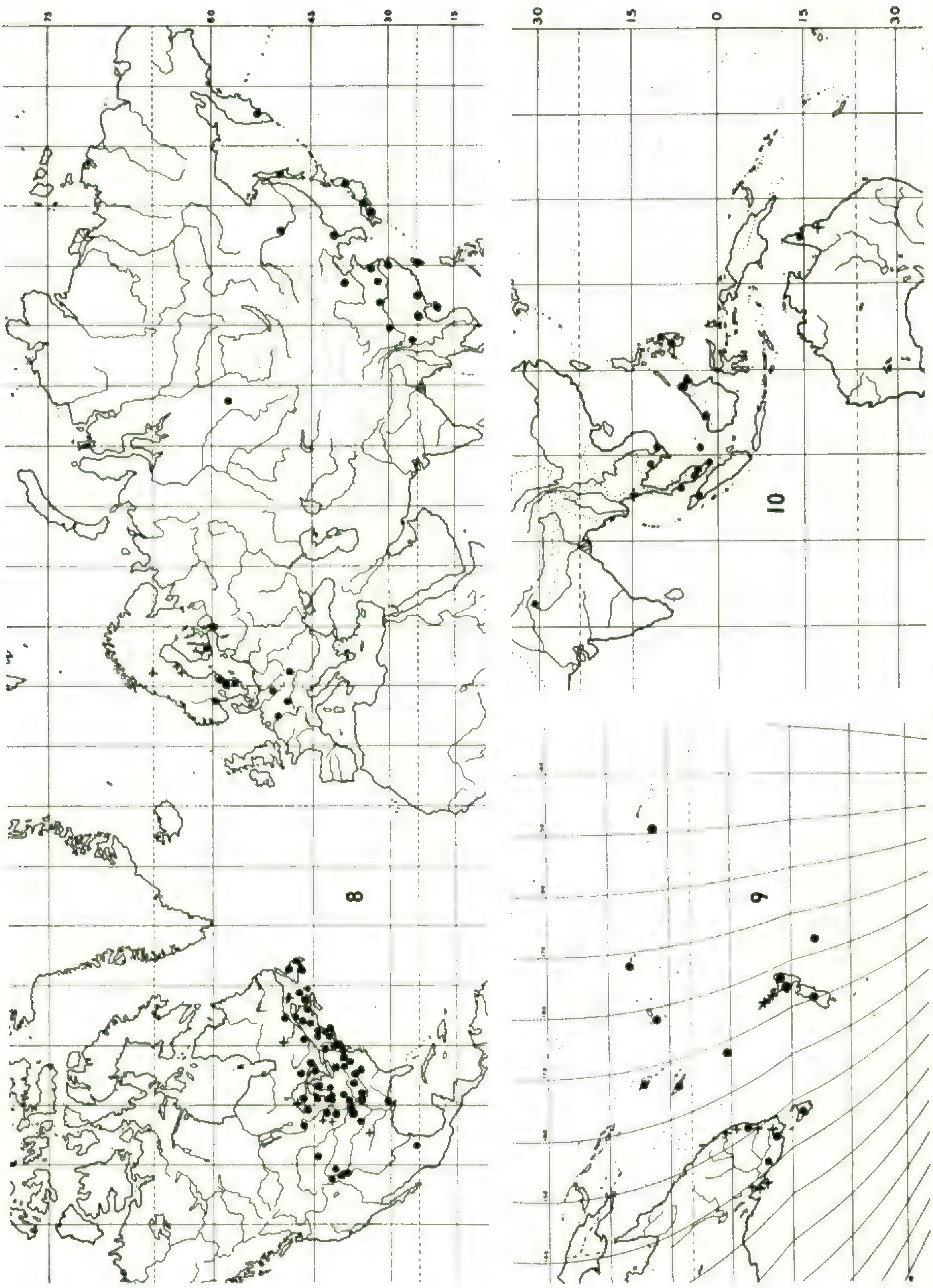
Var. *decompositum* is a part of the small element of the Hawaiian flora that is related to the American flora.

It occurs exclusively in the Hawaiian Islands, where it grows along field borders, in virgin land, on craters, on bare eroded slopes, on open grassy slopes and in thickets from 300 m. up to 2700 m.

HAWAIIAN ISLANDS.—KAUAI: June 22, 1895, *A. A. Heller* 2416 (F, G, NY, US). OAHU: Waianae Mts., Honouliuli, May 2, 1937, *Fosberg* 13810 (G); Koalau Mts., March 29, 1933, *Fosberg* 9320 (G); Wahiawa, June 3, 1909, *Forbes* (NY). MOLOKAI: Kahuaawi, May 30, 1928, *Degener* 3558 (NY, US). LANAI: Kaokahi, Nov. 28, 1935, *Fosberg* 12429 (G). MAUI: Aug. 22, 1933, *Fosberg* 9943 (G). HAWAII: Kilauea Bird Park, Aug. 5, 1925, *Neal* (NY).

6. PTERIDIUM AQUILINUM var. LATIUSCULUM (Desv.) Underw. ex Heller, Cat. N. Am. Pl. Ed. 3, 17 (1909). Plate 650, FIG. 8, PLATE 652, FIG. 1, MAP 8. Illustrations: Tilton, Fern Lover's Comp. 48, 49 (1922); Tryon et al., Ferns of Wis. 18, 19 (1940), *habitat;* Svensk Bot. **2:** t. 90 (1803).

Pteris caudata L. sensu Schk. Krypt. Gew. 88 (1809), in part, pl. 96b, a. *Pteris ciliata* Willd. ex Schk. Krypt. Gew. 89 (1809), in synonymy. *Pteris lanuginosa* Spreng. Nova Acta **10:** 231 (1821). *Pteris Sprengelii* Steud. Nom. Bot. **2:** 358 (1824). *Pteris latiuscula* Desv. Mém. Soc. Linn. **6**[2]**:** 303 (1827). *Pteris aquilina* L. var. *pubescens* Kze. Linnaea **13:** 142 (1839), as to



Ranges of Pteridium aquilinum var. latiusculum (map 8); var. esculentum (map 9); var. yarrabense (map 10).

basinym, *Pteris lanuginosa* Spreng., not as to plant. *Pteridium latiusculum* (Desv.) Hieron. ex Fries, Wiss. Ergebn. Schwed. Rhodesia-Kongo Exp. **1**[1]**:** 7 (1914). *Cincinalis latiuscula* (Desv.) Vict. Contrib. Lab. Bot. Univ. Montréal no. 2, 71 (1923), nomen provisorium. *Pteridium aquilinum* (L.) Kuhn var. *japonicum* Nakai, Bot. Mag. Tokyo **39:** 106 (1925), ex char. *Pteris latiuscula lanuginosa* Small, Ferns N. Y. 241 (1935), in synonymy. *Pteridium latiusculum* (Desv.) Hieron. ex Fries var. *verum* Wherry, Am. F. Journ. **27:** 58 (1937). *Pteridium aquilinum* (L.) Kuhn f. *glabrum* Tardieu-Blot and C. Chr. in Lecomte, Fl. Gen. Indo-Chine **7**[2]: 138 (1939). *Pteridium japonicum* (Nakai) Tardieu-Blot and C. Chr. in Lecomte, Fl. Gen. Indo-Chine **7**[2]: 138 (1939), in synonymy.

The earliest varietal name, *Pteris aquilina* L. var. *pubescens* Kze., cannot be transferred to *Pteridium aquilinum* because of *Pteridium aquilinum* var. *pubescens* Underw.

Growing tip of the rhizome usually *naked, or with a few whitish hairs,* rarely with a tuft of dark hairs; *frond* 0.3–1.5 m., usually about *0.5–1 m. high, vernation equal;* stipe longer or shorter than the blade; *blade* 2–8 dm., usually about *5 dm. long,* usually *broadly triangular,* rarely broadly ovate or ovate, often *ternate,* usually tripinnate or tripinnate-pinnatifid, sometimes bipinnate-pinnatifid; *rachis* usually *glabrous or subglabrous,* sometimes slightly pubescent; *pinnae and pinnules subacute to obtuse; pinnules* usually *at an oblique angle to the costa,* rarely nearly at right angles; costules slightly pubescent beneath and less so above, or glabrous; penultimate segments usually pinnate or pinnate-pinnatifid; *longest entire segment* or entire part of a segment from three to seven, usually *about four, times as long as broad; ultimate segments* usually *straight,* adnate or broadest at the base, the upper surface glabrous or subglabrous, the *margin pubescent,* or rarely subglabrous, the *lower surface* usually *pubescent only along the midnerve,* rarely slightly pubescent between the margin and the midnerve; *fertile and sterile indusium* usually *glabrous,* rarely the fertile slightly pubescent on the outer surface or ciliate, and the sterile slightly ciliate, the fertile 0.25–0.4 mm. wide, the sterile 0.1–0.2 mm. wide, the fertile portion broader than the sterile on the same segment.

Type: Sheet labeled *Pteris latiuscula* Desv., Herb. Desvaux in Herb. Muséum d'Histoire Naturelle, Paris (not seen). Photograph of type in U. S. National Herbarium and Gray Herbarium (seen).

Type locality: Newfoundland and St. Pierre.

In northern Europe, Kamtchatka and occasionally throughout its range in North America, plants of var. *latiusculum* occur that have the sterile indusium slightly ciliate and the lower surface of the blade somewhat pubescent between the margin and the midnerve. Such plants in North America are discussed under var. *pubescens*. Also, occasionally, the blade is ovate rather than broadly triangular. These are apparently normal variations in any large population of var. *latiusculum*.

In northern Wisconsin and adjacent Michigan, and perhaps more widely distributed, plants with an ovate blade, pubescent beneath between the margin and midrib, and with the sterile indusium ciliate are not uncommon (PLATE 652, FIG. 4). Representative specimens are: Boulder Junction, Vilas Co., Wisconsin, July 3, 1938, *Tryon* 3914 (G); Hersey, Osceola Co., Michigan, June 25, 1938, *Fassett* 19244 (G); Northwest of L'Anse, Baraga Co., Michigan, *Fassett* 19251 (G). They constitute a rather noticeable proportion of the var. *latiusculum* population. An attempt to identify such plants led me into this study of *Pteridium* but I am still unable to give a satisfactory interpretation of them. In the summer of 1940 I made an effort to study them in the field more closely than I had in 1938[20] but heavy late frosts had killed or mutilated most of the Bracken. They may be regarded as a scattered population intermediate between var. *pubescens* and var. *latiusculum*, closely related to the former in the characters given above but, I believe, derived from the latter by rhizomes or spores. Or, there is considerable evidence that they are merely the result of adverse growing conditions such as burning, pasturing, and extremes of exposure and soil sterility. They are found in especially dry, sunny places, often in pastures, fields, railroad rights-of-way and recently burnt-over land.

There is a certain amount of intergradation between var. *latiusculum* and var. *Wightianum*. Some specimens with the leaf-cutting of var. *latiusculum* are slightly pubescent beneath between the margin and the midnerve and have the sterile indusium slightly ciliate, while others have tapering pinnules set at right angles to the costa, as in var. *Wightianum*, and are pubescent beneath only on the midnerve. Such intermediates

[20] See Tryon, Notes on the Ferns of Wisconsin. Am. F. Journ. **29**: 1 (1939).

are: Kwangtung, China, Jan. 4, 1928, *Tsang* 16704 (F); Kwangtung, China, *Lau* 2353 (G); Canton, China, 1874, *Poli* (Herb. Field Mus. no. 593622); near Kau Fung, Loh Ch'ang Dist., Kwangtung, China, Nov. 2–30, 1932, *Tsang* 20872 (NY, US); Foochow, Fukien Prov., China, *Metcalf* 7406 (US); Wang Shan, Anhwei Prov., China, Aug. 28, 1923, *Ip* (US); Mt. Rengger, Java, Sept. 25, 1907, *Buysman* (US).

Var. *latiusculum* may be separated from var. *Wightianum* by its equal rather than gleichenioid vernation, its broadly triangular and ternate rather than ovate-triangular and evenly pinnate blade, its nearly glabrous rather than densely pubescent rachis and its subacute or obtuse rather than long-acuminate pinnae and pinnules. Also the ultimate segments are straight rather than falcate, the lower surface is glabrous except along the midnerve rather than densely pubescent, the fertile and sterile indusium are glabrous or nearly so rather than quite ciliate and the pinnules are at an oblique angle to the costa rather than at right angles.

Vars. *typicum*, *pubescens* and *pseudocaudatum* are also closely related to var. *latiusculum* and the critical differences are discussed under their treatments.

Var. *latiusculum*, in eastern North America and eastern Asia, is another example of the well-known relationship of the floras of those two areas. The localities in the Black Hills of South Dakota and the mountains of Wyoming, Colorado and Nuevo Leon undoubtedly represent relics of a once continuous range, the intervening population perhaps having been wiped out by aridity in the Great Plains Region. I do not have enough data at hand to interpret the occurrence of var. *latiusculum* in northern Europe. It may have survived glaciation in local nunatak areas in Scandinavia and spread since the disappearance of the ice, or it may have spread, since glaciation, westward from unglaciated areas in western Siberia. Var. *latiusculum* is probably more widely distributed in central Asia than Map 8 indicates. Several of the localities in central Asia on Map 1 probably represent var. *latiusculum*.

Var. *latiusculum* grows in pastures, open woods, thickets, on open slopes, in woods, on grassy slopes in abandoned fields and in burnt-over areas, in damp or more often dry, usually sterile

soil; from sea level up to 1500 m. in eastern North America, 2300 m. and 2700 m. in the mountains of Wyoming and Colorado and up to 2000 m. in China.

It ranges from Newfoundland to Minnesota, south to Oklahoma and Tennessee; isolated in Mississippi, Wyoming, South Dakota, Colorado and Nuevo Leon; Sweden south to Germany, east to western Russia; Siberia; Kamtchatka to Amur, south to Formosa, Hainan and Szechuan.

North America.—Saint Pierre: Cape Noir, July 10, 1901, *Arsène* 6 (G); July 10, 1909, *Arsène* 5 (NY). Ile Miquelon: July 27, 1882, *Delamare* 364 (NY). Newfoundland: Holyrood, South Arm River, Aug. 23, 1894, *Robinson & Schrenk* 4 (F, G, NY, US); Grand Falls, July 10, 1911, *Fernald & Wiegand* 4281 (G). Dominion of Canada. Quebec: Boishébert, Mutton Bay, Saguenay Co., Aug. 15, 1915, *H. St. John* 90010 (G); Seven Islands, Saguenay Co., Aug. 12, 1907, *C. B. Robinson* 873 (NY); Bic, Rimouski Co., Aug. 15, 1927, *Rousseau* 26884 (G); Northwest of Three Rivers, Champlain Co., Aug. 1, 1923, *Chamberlain & Knowlton* (G); Grindstone, Grindstone Island, Magdalen Islands, Aug. 23, 1912, *Fernald, Long & St. John* 6645 (G). Prince Edward Island: Dundee, Kings Co., Aug. 26, 1912, *Fernald, Long & St. John* 6646 (G). New Brunswick: Shediac Cape, July 23, 1914, *F. T. Hubbard* (G). Nova Scotia: Brazil Lake, Yarmouth Co., July 16, 1921, *Bartram & Long* 23003 (G); Digby, July 2–7, 1901, *Howe & Lang* 258 (G, NY). Ontario: Moore Lake, Bruce Peninsula, Aug. 26, 1934, *Krotkov* 9606 (G, US); east end of Timagami Lake, Timagami Provincial Forest, Aug. 4–11, 1935, *E. C. & T. G. Yuncker* 5499 (F); Laurier, Parry Sound District, Aug. 13, 1905, *Moyer* (NY). United States of America. Maine: Mt. Katahdin, July 14, 1900, *Fernald* (G); Boundary Lake, Aroostook Co., Aug. 12, 1902, *Eggleston & Fernald* (G). New Hampshire: Randolph, Sept. 1, 1903, *A. H. Moore* 1454 (G); Jaffrey, July 25, 1897, *B. L. Robinson* 287 (G). Vermont: Manchester, July 27, 1898, *Day* 260 (G); Brandon, May 23, 1908, *E. F. Williams* (G). Massachusetts: Sharon, July, 1905, *S. F. Poole* 307 (G); Tisbury, Martha's Vineyard, June 16, 1917, *F. C. Seymour* 1001 (G, US); Granville, Sept. 19, 1913, *Seymour* 60 (NY). Rhode Island: Barrington, Bristol Co., Sept. 15, 1906, *M. H. Grant* (G). Connecticut: North Guilford, Sept. 30, 1906, *G. H. Bartlett* (G); Southington, Sept. 20, 1898, *Bissell* 830 (G). New York: Ithaca, Tompkins Co., Sept. 3, 1914, *Metcalf* 1405 (G); Staten Island, July 16, 1906, *Dowell* 4506 (G, US). New Jersey: Budd's Lake, Sussex Co., Aug. 12–14, 1890, *Small* (F). Pennsylvania: Wissahickon

Ravine, Philadelphia Co., July 19, 1924, *Lang* 626 (G); Reading, Berks Co., Sept. 11, 1929, *E. J. Palmer* 36311 (G). MARYLAND: between Oakland and Thayerville, Garrett Co., July 5, 1913, *Tidestrom* 6457 (G); Cumberland, 1894, *Shriver* (NY). DISTRICT OF COLUMBIA: Terra Cotta, June 17, 1888, *Holm* (G). WEST VIRGINIA: White Sulphur Springs, Greenbrier Co., May 14–17, 1914, *Hunnewell* (G); Whitmer, Randolph Co., Sept. 13, 1904, *A. H. Moore* 2221 (G). VIRGINIA: Bull Run Mts., Fauquier Co., June 9, 1935, *Allard* 598 (G, NY); Marion, Smyth Co., June, 1892, *Britton, Britton & Vail* (NY). NORTH CAROLINA: near Waynesville, Sept. 5, 1910, *Standley* 5529 (US). MICHIGAN: 4 miles northwest of Calumet, Houghton Co., July 24, 1936, *Hermann* 8264 (NY); Ludington, Mason Co., Sept. 17, 1910, *Chaney* 256 (F, G, US). OHIO: Berea, July, 1897, *Ashcroft* (Herb. Field Mus. nos. 140093, 140094); Hiram, Portage Co., Aug. 15, 1897, *Webb* 265 (G). INDIANA: Millers, Lake Co., July 7, 1908, *Lansing* 2759 (F, G); Lake Oliver, July 16, 1933, *Shoop* (Herb. Field Mus. nos. 907912, 907922). KENTUCKY: Burnt Bridge Ridge, Madison Co., July 7, 1937, *Smith, Hodgdon & Brown* 3625 (G); Pine Mt., Bell Co., Sept., 1893, *Kearney* (US). TENNESSEE: South of Craggie Hope, Cheatham Co., Aug. 20, 1922, *Svenson* 342 (G); Henderson, June, 1892, *Bain* (NY). MISSISSIPPI: Biloxi, June 3, 1898, *Tracy* 5171 (F, NY, US). WISCONSIN: Delavan, July 13, 1919, *Hollister* 146 (G, US); Solon Springs, Douglas Co., Sept. 7, 1930, *Somerville* 41 (G). ILLINOIS: Starved Rock, La Salle Co., Sept. 7, 8, 1914, *Lansing* 3786 (F); Joliet, Sept. 20, 1904, *Skeel* 549 (F); Pine Hills, Union Co., May 6, 1902, *Gleason* 2899 (G). MINNESOTA: St. Cloud, July, 1896, *Campbell* (F); Itasca Park, Clearwater Co., July 16, 1933, *Mayle* 654 (G, NY). IOWA: Fayette Co., July, 1894, *B. Fink* 444 (G, US); Lebanon, July 5, 1897, *Sample* 502 (G, US). MISSOURI: Monteer, Oct. 24, 1907, *Bush* 1146 (G, NY, US); Ironton, June 23, 1897, *Savage & Stull* 328 (F). ARKANSAS: Jasper, Newton Co., June 18, 1932, *D. M. Moore* 32503 (G). SOUTH DAKOTA: Custer, Black Hills, Aug. 19, 1892, *Rydberg* 1192 (NY, US); Pinecrest Camp, Deadwood, 1927, *Haywood* 1115 (F). WYOMING: Jackson's Hole, Lincoln Co., Aug. 11, 1920, *L. B. & E. B. Payson* 2275 (G); Laramie Peak, Albany Co., July 10, 1900, *Nelson* 7518 (G, NY). COLORADO: Rabbit Ear Range, Routt Co., July 18, 1903, *Goodding* 1595 (G, NY, US); Brush Creek, Sept. 9, 1910, *Tidestrom* 4166 (G).—MEXICO: Sierra Madre Mts., Monterey, Nuevo Leon, July 6, 1933, *C. H. & M. T. Mueller* 366, in part (G).

EUROPE.—NORWAY: Bygdö, June 28, 1907, *O. Anderson* (US). SWEDEN. (STOCKHOLM): near Stockholm, Sept. 18, 1887, *A. F. Carlson* (US). ÖSTERGÖTLAND: Aug. 8, 1915, *A. O. Olson* (Herb.

Field Mus. no. 821335); Ljushult, July 21, 1911, *A. O. Olson* (NY); Asunden, Aug. 17, 1915, *A. O. Olson* (NY). Kalmar (Småland): Kalmar, 1882, *Linddorff* (G).—Finland: Nyland, Aug. 20, 1908, *H. Lindberg* 409 (NY). Germany: near Berlin, July, 1844, *Gausauge* (G); Hanau, Sept., 1910, *Peipos* (Herb. Field Mus. no. 756316); Nürnberg, Bavaria, Aug. 15, 1910, *Honig* (G). Czechoslovakia: Moravia, Sept. 13, 1925, *J. Bily* 103 (G). Union of Soviet Socialist Republics: St. Petersburg, 1860 (Herb. Field Mus. nos. 29377, 162025).

Asia.—Siberia. Tomsk: near Titovka, Aug. 29, 1928, *Protopopova* (G). Kamtchatka: Savoiko, Aug. 29, 1928, *Eyerdam* (G, NY, US); Petropavlovsk, Aug. 6, 1928, *Eyerdam* (F, G, NY, US). Primorsk: Vladivostok, May–Oct., 1919, *Topping* 2343 (US). Amur: Blagowjeschtschensk, 1906, *Karo* (G, US).—Sachalin: 1872, *Augustinowicz* (G). Japan: *Maries* (U. S. Nat. Herb. no. 022422); June, 1896, *Halbrook* 40 (NY); Atago, Oct. 13, 1894, *Stanford* (Herb. Field Mus. no. 825006) (NY); Sakamoto, Aug. 8, 1929, *Dorsett & Morse* 897 (US); Kano San, Kadsusa, Sept., 1888 (U. S. Nat. Herb. no. 22432); Mt. Kano San, Kadsusa, Sept. 7, 1908 (U. S. Nat. Herb. no. 1095365); Yase near Kyoto, June, 1921, *Husimi* (U. S. Nat. Herb. no. 1704754); Nanokawa, Tosa, July 3, 1892 (U. S. Nat. Herb. no. 22439). Formosa: *Hancock* 56 (US). China. Manchuria: 1931, *Chen* 494 (NY). Chihli: Tungling Mts., May 18, 1921, *Cowdry* 1214 (US). Kiang Su: Poa Wha Mt., Chu-Yung, Oct. 10, 1915 (U. S. Nat. Herb. no. 1094030). Chekiang: Mo Kan Shan, June 28, 1926, *Cheo & Wilson* 12663 (G). Anhwei: Chiu Hua Shan, June 28, 1925, *Ching* 8478 (G, NY). Hupeh: 1885–88, *Henry* 3146 (G); Wuchang, June, 1932, *Chung* 9058 (F). Kiangsi: Lu Shan, Sept. 19, 1922, *Steward* 2724 (US). Kwangtung: Hong Kong, 1853–56, *Wright* (G, US). Hainan: Ka Chik Shan, April 25, 1933, *Lau* 1637 (G). Yunnan: Ping-pien Hsien, June 5, 1934, *Tsai* 60128 (G). Szechuan: Mt. Omei, Omei Hsien, 1928, *Fang* 3034 (G), 3231 and 3317 (G, US); Nanchuan Hsien, 1928, *Fang* 5841 (G).—French Indo-China: Nov., 1921 (U. S. Nat. Herb. no. 1505970).

7. Pteridium aquilinum var. pseudocaudatum (Clute) Heller, Cat. N. Am. Pl. Ed. 2, 12 (1900). Plate 650, fig. 7, plate 652, fig. 2, map 5. Illustration: Blomquist, Ferns of N. Car. 42 (1934).

Pteris caudata L. sensu Schk. Krypt. Gew. 88 (1809), in part, Pl. 96b, b. *Pteris novae-angliae* Bory ex Hook. Sp. Fil. **2:** 197 (1858), in synonymy. *Pteris aquilina* L. var. *pseudocaudata* Clute, Fern Bull. **8:** 39 (1900). *Pteridium aquilinum pseudocaudatum* (Clute) Clute, Fern Bull. **8:** 39 (1900), nomen pro-

visorium. *Pteris pseudocaudata* (Clute) Anon. in Index, Proc. Biol. Soc. Wash. **14:** 200 (1901). *Pteris latiuscula pseudocaudata* (Clute) Clute, Fern Bull. **11:** 62 (1903), nomen provisorium. *Pteridium latiusculum pseudocaudatum* (Clute) Maxon, Am. F. Journ. **9:** 44 (1919). *Filix-foemina aquilina* (L.) Farwell var. *pseudocaudata* (Clute) Farwell, Am. Mid. Nat. **12:** 290 (1931). *Pteris latiuscula* Desv. var. *pseudocaudata* (Clute) E. P. St. John, Am. F. Journ. **25:** 40 (1935).

Growing tip of the rhizome usually *with a tuft of dark hairs;* frond 0.3–1.5 m., usually about 0.5–1 m. high, vernation equal; stipe longer or shorter than the blade; *blade* 2–7 dm., usually about 5 dm. long, usually *broadly triangular,* rarely broadly ovate or ovate, sometimes *ternate,* bipinnate-pinnatifid or tripinnate, rarely tripinnate-pinnatifid; *rachis glabrous;* pinnae and pinnules acute to obtuse; pinnules usually at an oblique angle to the costa, rarely at right angles; costules glabrous or less often slightly pubescent; penultimate segments pinnatifid or pinnate, rarely pinnate-pinnatifid; *longest entire segment* or entire part of a segment from six to fifteen, usually *about nine, times as long as broad;* ultimate segments usually straight, adnate or broadest at the base, the upper surface glabrous, the *margin* usually *glabrous,* rarely slightly pubescent, the *lower surface glabrous,* or sometimes pubescent along the midnerve; *fertile and sterile indusium glabrous,* the fertile 0.3–0.4 mm. wide, the sterile 0.1–0.2 mm. wide, the fertile portion broader than the sterile on the same segment.

TYPE: *Clute* 339, isotype in Herb. New York Botanical Garden (seen).

TYPE LOCALITY: Babylon, Long Island, New York.

It is interesting to note that in 1899, one year before Clute described var. *pseudocaudatum,* Maxon identified *Ball* 511 as "*Pteris aquilina* L. var. nov." "not typical—approaching *P. caudata* Linn."

Var. *pseudocaudatum* intergrades to a considerable extent with var. *latiusculum.* Intermediate specimens have the leaf-cutting of var. *latiusculum* but are nearly glabrous or have the leaf-cutting approaching var. *pseudocaudatum* and are either glabrous or have a pubescent margin and midnerve. Such specimens are: Hammonton, New Jersey, May 30, 1919, *Killip* 2260 (US); Bladensburg, Maryland, July 31, 1919, *Maxon* 6461 (G); Table Rock, North Carolina, June, 1879 (Herb. Field Mus. no. 315115, U. S. Nat. Herb. no. 22450); near White Sulphur Springs, Greenbrier Co., West Virginia, Aug. 29, 1903, *Mackenzie*

381 (NY); Henderson, Tennessee, June, 1892, *Bain* 162 (G); Wasioto, Bell Co., Kentucky, Sept., 1893, *Kearney* (NY); Bowling Green, Kentucky, July, 1891, *Price* (NY). *Lansing* 513, West Pullman, Illinois, Sept. 18, 1898 (F) approaches var. *pseudocaudatum*. This strongly suggests that typical var. *pseudocaudatum* occurs at the southern tip of Lake Michigan, and it has been reported from the Dunes Region,[21] but I have not seen any specimens.

Var. *pseudocaudatum* may be separated from var. *latiusculum* by the glabrous or subglabrous rather than pubescent margin of the segments, the usually glabrous rather than pubescent midnerve and the long and narrow rather than relatively short and broad segments. Also the growing tip of the rhizome usually has a tuft of dark hairs.

Although not closely related, var. *africanum* approaches var. *pseudocaudatum* in some characters and the differences are discussed under the former variety.

Var. *pseudocaudatum* grows in open woods, pastures, thickets, in burnt-over areas and abandoned fields, usually in dry sterile soil but sometimes in fairly damp or rich places.

It is primarily of Coastal Plain distribution: Cape Cod, Massachusetts, and Long Island, New York, to Florida and Texas; also inland in North Carolina, Tennessee, West Virginia, Ohio, Indiana, Missouri, Arkansas and Oklahoma.

United States of America.—Massachusetts: Harwich, Barnstable Co., Sept. 2, 1918, *Fernald & Long* 15914 (Herb. New Eng. Bot. Club). New York: Babylon, Long Island, Sept. 8, 1898, *Clute* 339 (NY), isotype of *Pteris aquilina* var. *pseudocaudata* Clute. New Jersey: Hammonton, Aug. 19, 1879, *Kitchel* (G); Atsion, Burlington Co., Aug. 10, 1926, *Benner, Long & Bassett* (G). Delaware: Seaford, Aug., 1874, *Canby* (Herb. Field Mus. no. 149427); Laurel, Sussex Co., Aug. 19, 1880, *Commons* (G). Maryland: 3 miles southeast of Ridgely, Caroline Co., Sept. 24, 1938, *Wherry* (G). West Virginia: Rickett's Place, Cabell Co., Sept. 13, 1936, *F. A. Gilbert* 519 (F, NY). Virginia: Ocean View, Norfolk Co., Oct. 4, 1912, *Tidestrom* 6184 (G); Buckroe, May 18, 1912, *B. L. Robinson* 341 (G); Great Dismal Swamp, June 18, 1936, *Fulling* (NY). North Carolina: Tryon, Polk Co., May, 1918, *Millspaugh* 4083 (F); 4 miles east of Hamlet, Richmond Co., July 2, 1927, *Wiegand &*

[21] Peattie, Fl. Ind. Dunes, 29 (1930): "acc. to Clute".

Manning 21 (G); Goldsboro, Wayne Co., June 21, 1935, *Correll* 1382 (G). SOUTH CAROLINA: near Navy Yard, Charleston, May 4, 1912, *B. L. Robinson* 198 (G); Myrtle Beach, Horrey Co., June 12, 1936, *Correll* 5218 (G); Laurel Hill, July 6, 1936, *Tarbox* 735 (NY). GEORGIA: Sumter Co., July 24, 1901, *Harper* 1110 (F, G, NY, US); Near Darien, McIntosh Co., June 20, 1936, *Correll* 5456 (G). FLORIDA: Warrenton, May 23, 1903, *Tracy* 8633 (F, G, US); Eustis, Lake Co., May 1–15, 1894, *Nash* 638 (F, G, NY, US). KENTUCKY: Mammoth Cave Road, Edmonson Co., July 2, 1916, *King* 121 (F). TENNESSEE: Lookout Mt., *Eggleston* (NY). OHIO: Salem Township, Meigs Co., Oct. 10, 1931, *C. H. Jones* (Herb. Ohio U.). INDIANA: 1 mile east of Taswell, Crawford Co., Aug. 17, 1913, *Deam* 13976 (Deam Herb.); ½ mile south of Emison, Knox Co., Sept. 2, 1939, *Tryon* 4268 (G). ALABAMA: Mobile Co., June, 1905, *Dukes* (G); near Fairfax, Chambers Co., Aug. 17, 1936, *Correll* 6562 (G); Auburn, Lee Co., Oct. 14, 1897, *Earle & Baker* (NY). MISSISSIPPI: West of Kosciusko, Attala Co., May 17, 1933, *C. A. & U. F. Weatherby* 6300 (G, NY, US); French Camp, April 28, 1899, *I. M. Clute* 54 (F, NY). MISSOURI: Monteer, May 14, 1901, *Bush* 474 (G); Chadwick, Christian Co., Oct. 5, 6, 10, 1915, *Eggleston* 12187 (NY); Webb City, Jasper Co., Aug. 22, 1920, *E. J. Palmer* 18788 (NY). ARKANSAS: Nashville, Howard Co., Oct. 19, 1932, *Demaree* 9952 (G); West Otis, Sevier Co., July 26, 1937, *Brinkley* 256 (F); Wilmar, Drew Co., Oct. 12, 1936, *Demaree* 14008 (NY). LOUISIANA: Alexandria, May 31, 1899, *C. R. Ball* 511 (F, G, NY, US); Chapin, Natchitoches Parish, Oct. 5, 1915, *E. J. Palmer* 8845 (NY). OKLAHOMA: Page, LeFlore Co., Sept. 9, 1913, *Stevens* 2715 (G, US); Idabel, McCurtain Co., May 29, 1916, *Houghton* 3909 (G, NY). TEXAS: 10 miles south of Yellow Pine, Sabine Co., Oct. 3, 1934, *Cory* 10750 (G); Huntsville, June 3–12, 1908, *Dixon* 122 (F); Houston, Harris Co., May 18, 1917, *E. J. Palmer* 11942 (NY).

8. PTERIDIUM AQUILINUM var. AFRICANUM[22] Bonap. Notes Ptérid. **1:** 62 (1915). PLATE 650, FIG. 6, PLATE 652, FIG. 3, MAP 6.

*Pteridium *centrali-africanum* Hieron. ex Fries, Wiss. Ergebn. Schwed. Rhodesia-Kongo Exp. **1**[1]**:** 7 (1914). *Pteridium aquilinum* (L.) Kuhn var. *caudatum* (L.) Sadebeck f. *africanum* (Bonap.) Bonap. Notes Ptérid. **14:** 321 (1923).

Growing tip of the rhizome with a tuft of dark hairs; frond 0.6–1 m. high, *vernation gleichenioid;* stipe shorter than the blade; blade 4–8 dm. long, *ovate to broadly ovate,* not ternate, tripinnate-pinnatifid, or more often quadripinnate; rachis glabrous or subglabrous; pinnae and pinnules acute to obtuse;

[22] Described under ssp. *caudatum.*

pinnules at an oblique angle to the costa; costules glabrous to slightly pubescent; penultimate segments pinnate; longest entire segment or entire part of a segment from five to eight times as long as broad; ultimate segments usually straight, at least some, often many, *narrowed at the base,* the upper surface glabrous, the *margin glabrous,* the *lower surface glabrous* or very slightly pubescent on the midnerve; *fertile and sterile indusium glabrous,* the fertile usually 0.3 mm. wide, the sterile 0.1–0.2 mm. wide, the fertile portion broader than the sterile on the same segment, or no broader.

Type: *Busse* 944, in Herb. Muséum d'Histoire Naturelle, Paris (not seen).

Type Locality: "Afrique Orientale allemande. Magaba-Thal."

Var. *africanum* may be separated from var. *typicum* by its more finely cut, often quadripinnate, blade, its glabrous rather than pubescent rachis and its glabrous rather than ciliate fertile and sterile indusium. Also the pinnules are at an oblique angle to the costa rather than at right angles and the ultimate segments are usually narrowed at the base and glabrous or subglabrous rather than adnate or broadest at the base and densely pubescent beneath. It differs from var. *pseudocaudatum* in its gleichenioid rather than equal vernation, its ovate or broadly ovate rather than broadly triangular blade and in that the ultimate segments are usually narrowed rather than adnate or broadest at the base.

Var. *africanum* grows in dry moderately light woods, in virgin forest and in open grassland in tropical Africa, up to 1400 m.

Africa.—Belgian Congo: Stanley Pool, Sept., 1883, *H. H. Johnston* (U. S. Nat. Herb. no. 22427); Elizabethville, Dec. 30, 1919, *Shantz* 513 (US); Albertville, 1931, *Lugen* 89 (G). Portuguese West Africa: Near Cuanza River, Sept. 24, 1923, *A. G. Curtiss* 358 (G). Union of South Africa: Ndola, northern Rhodesia, *Stevensen* 400 (US). Tanganyika (German East Africa): N'Gano-N'Gano, Urundi, March 17, 1919, *Schantz* 757 (US).

Pteridium aquilinum ssp. caudatum (L.) Bonap. Notes Ptérid. **1:** 62 (1915)

Growing tip of the rhizome with a tuft of dark hairs; rachis glabrous to slightly pubescent, rarely densely pubescent; costae glabrous to moderately pubescent; pinnules usually nearly at right angles to the costa, rarely at a somewhat oblique angle;

Ranges of Pteridium aquilinum var. caudatum (map 11); var. arachnoideum (map 12).

longest entire segment or entire part of a segment variable, from four to seventeen times as long as broad; *ultimate segments* usually linear to long-linear, sometimes ovate or oblong-ovate, mostly *decurrent or more strongly decurrent than surcurrent*, sometimes most, but not all, of the segments adnate, the upper surface glabrous to moderately pubescent, the *lower surface* usually *appressed-pubescent with straight hairs or arachnoid-pubescent*, rarely sublanuginose or glabrous, usually *having a farinaceous appearance* (plate 650, fig. 13), fertile indusium 0.3–0.5 mm. wide, the sterile 0.1–0.35 mm. wide. Map 1 (stars).

9. Pteridium aquilinum var. caudatum (L.) Sadebeck,[23] Jahrb. Hamb. Wiss. Anst. **14:** Beiheft 3, 5 (1897), as to indicated basinym *Pteris caudata* L., not as to plant. Plate 650, figs. 9, 12, plate 653, fig. 4, map 11. Illustrations: Plumier, Pl. Amer. t. 22 (1693); Jacquin, Ic. Pl. Rar. **3:** t. 645 (1786–1793); Britton, Fl. Bermuda, 419 (1918).

Pteris caudata L. Sp. Pl. Ed. 1, **2:** 1075 (1753). *Pteris aquilina* L. var. *caudata* (L.) Link, Hort. Berol. **2:** 33 (1833). *Allosorus caudatus* (L.) Pr. Tent. Pterid. 154 (1836). *Pteris aquilina* L. var. *mexicana* Fée, Mém. Fam. Foug. **8:** 114 (1857). *Pteris caudata* L. var. *mexicana* Fée, Mém. Fam. Foug. **9:** 8 (1857), nomen nudum. *Ornithopteris caudata* (L.) J. Sm. Hist. Fil. 298 (1875). *Cincinalis caudata* (L.) Trevis. Atti Soc. Ital. sc. nat. **17:** 239 (1875). *Pteridium caudatum* (L.) Maxon, Proc. U. S. Nat. Mus. **23:** 631 (1901). *Pteridium aquilinum* (L.) Kuhn var. *caudatum* (L.) Sadebeck f. *glabratum* Hieron. Hedwigia **48:** 246 (1909). *Pteridium aquilinum* (L.) Kuhn var. *caudatum* (L.) Sadebeck f. *pubescens* Hieron. Hedwigia **48:** 246 (1909). *Filix-foemina aquilina* (L.) Farwell var. *caudata* (L.) Farwell, Am. Mid. Nat. **12:** 290 (1931).

Frond 0.6–7 m., usually about 1.2–2.5 m. high, the taller fronds scandent, vernation not clearly observed, apparently gleichenioid; stipe usually about as long as the blade; blade 0.3–4 m., usually about 0.6–1 m. long, triangular to broadly ovate or long-triangular in large plants, tripinnate, or more usually tripinnate-pinnatifid or quadripinnate; costules of the penultimate segments usually glabrous, sometimes slightly pubescent above and beneath with long white hairs, rarely pubescent above with short white hairs, or beneath with dark or bicolorous hairs; *free lobes not present* along the rachis, costae and costules; ultimate segments usually linear or long-linear, sometimes oblong-ovate or ovate, the margin glabrous or infrequently slightly pubescent, the *lower surface* usually *densely appressed-pubescent with long straight hairs*, rarely arachnoid-pubescent, sometimes glabrous, *having a farinaceous appearance* except in the glabrous

[23] On many of my annotation labels the combination is accredited to Underwood (1900).

forms, the *midnerve usually glabrous*, rarely pubescent with dark or bicolorous hairs, *only rarely membranous wings present* along the veins and midnerve; fertile and sterile indusium usually glabrous, sometimes slightly or densely ciliate, the *fertile portion broader than the sterile* on the same segment; *cells of the sterile indusium large, in fairly definite rows* (PLATE 650, FIG. 12).

TYPE: Specimen in the Linnaean Herb. (not seen). Linnaeus had two specimens labelled *Pteris caudata* in his herbarium in 1753.[24] One is apparently var. *pseudocaudatum* and the other is clearly var. *caudatum.* The latter specimen is taken as the type. Since Linnaeus' description in the Species Plantarum was taken from his Hortus Cliffortianus, a specimen, if there is one, in the Clifford Herbarium might be considered to be the type. However, since there is a perfectly good specimen available in Linnaeus' own herbarium, it seems best to designate that as the type. Although one of Linnaeus' specimens is apparently var. *pseudocaudatum,* the application of his name is perfectly clear from the figures and localities cited by him.

TYPE LOCALITY: West Indies. Linnaeus, Sp. Pl.: "Jamaica, Dominica.", Hort. Cliff.: "Santo Domingo, Jamaica etc."[25]

The typical phase of var. *caudatum,* with the segments long and narrow and remote, occurs mainly in the West Indies, Florida and in the coastal regions of northern South America, Central America and Mexico. At the higher altitudes, mostly in Central America and Mexico, there is a phase with the segments relatively short and broad and approximate. The extremes of this phase (Lago San José, Porto Rico, July 15, 1912 (U. S. Nat. Herb. no. 566772); San Jose, Tamaulipas, Mexico, 600–1100 m., 1902, *Kemp* (NY); San Rafael de Norte, Nicaragua, March 25, 26, 1917, *Miller & Griscom* 157 (US); Costa Rica, 1800 m., Aug. 2, 1933, *Solis* 277 (F); Columbia, *Charetier* 33 (NY, US); El Salvador, 1200–1500 m., *Standley* 21537; Nicaragua, 850 m., *Maxon, Harvey & Valentine* 7421) are well marked, but there is a great deal of intergradation from one phase to the other. In fact, almost a third of the specimens I have examined are intermediate, and the ranges overlap considerably in individual

[24] Mr. C. A. Weatherby has kindly made his notes on the Linnaean Herbarium available to me.

[25] Linnaeus, Hortus Cliffortianus, 473 (1737).

cases. I do not believe that this variation can reasonably be given varietal status.

Occasional specimens, especially of the "compact" phase mentioned above, but also of the typical phase, have the segments only slightly decurrent but these can usually be placed in var. *caudatum* by the characteristic pubescence.

Anthony 400, Lower California, has the lower surface of the segments appressed-pubescent with short hairs as is often the case in var. *esculentum.*

Var. *caudatum* can be distinguished from var. *esculentum* by its lack of free lobes along the rachis, costae and costules; and the fertile indusium is broader than the sterile on the same segment rather than usually no broader. Also the glabrous phases of var. *caudatum* do not have a farinaceous appearance.

Var. *caudatum* is most closely related to var. *arachnoideum;* the differences are discussed under that variety.

It grows in clearings, rough pastures, on dry hillsides, in cut-over forest land, in fresh-water marshes, in pinelands, scrublands and in shady rocky places, mostly at the lower altitudes but up to 2000 m. in Central America and Mexico, and 3000 m. in Venezuela; and from 1000 m. to 1300 m. in the Revillagigedo Islands.

It occurs from Bermuda to Florida, West Indies, Mexico, Central America and northernmost South America.

UNITED STATES OF AMERICA.—FLORIDA: Fort Myers, Lee Co., June 1, 1916, *J. P. Standley* 213 (F, G, NY, US); Cape Sable, July, *A. H. Curtiss* 3705* (F, G, NY, US).

BERMUDA: Devonshire Marshes, Aug. 31–Sept. 20, 1905, *Brown & Britton* 159 (F, G, NY, US).

WEST INDIES:—BAHAMA ISLANDS: Near Nassau, Feb. 11, 1903, *A. H. Curtiss* 74 (F, G, NY, US); Orange Creek and vicinity, Cat Island, Feb. 27, 28, 1907, *Britton & Millspaugh* 5754 (F, NY). CUBA: Monte Verde, Jan.–July, 1859, *Wright* 872 (F, G, NY, US); Josephina, north of Jaguey, Yateras, Oriente, April 23, 1907, *Maxon* 4129 (G, NY, US). JAMAICA: Mulgrove, north of Ipswich, St. Elizabeth, April 1, 1920, *Maxon & Killip* 1488 (F, G, NY, US). HISPANIOLA: Anse Galette, Gonave Island, Haiti, March 3–14, 1920, *Leonard* 3210 (F, G, US), 3208 (NY); Vicinity of Mission, Haiti, April 17–May 4, 1920, *Leonard* 3916 (US); San Lorenzo Bay, south coast of Samana Bay, Dominican Republic, April 5–11, 1921, *Abbott* 1275 (G, US); Province of

Barahona, Dominican Republic, July, 1911, *Fuertes* 1053 (F, G, NY, US). PORTO RICO: Santurce, Jan. 22, 1903, *A. A. Heller* 6446 (F, G, NY, US). MONTSERRAT: *Turner* (U. S. Nat. Herb. no. 428409). ANTIGUA: (US).

MEXICO.—Islands off the coast of Lower California and on the adjacent mainland, March–June, 1897, *Anthony* 400 (F, G, NY, US). NUEVO LEON: Sierra Madre, July 6, 1933, *C. H. & M. T. Mueller* 366, in part (G). TAMAULIPAS: La Vegonia, San Jose, July 5, 1930, *Bartlett* 10096 (US). SINALOA: Sierra de Chabarria, 1927, *Ortega* 4079 (US). NAYARIT (TERR. TEPIC): Jan. 5–Feb. 6, 1892, *E. Palmer* 1948 (G, US); Jalisco, Nov. 11, 1925, *Ferris* 5958 (G, US). VERA CRUZ: Mt. Orizaba, Aug. 21, 1891, *Seaton* 110 (F, G, NY); near Jalapa, May 12, 1900, *Pringle* 8342 (G, NY, US). COLIMA: Socorro Island, Revillagigedo Islands, May 8, 1925, *Mason* 1662 (G, US). GUERRERO: Montes de Oca, San Antonio-Buenos Aires, May 5, 1938, *Hinton* 14083 (G, US). OAXACA: Tolosita, June, 1937, *L. Williams* 9614 (F). CHIAPAS: Tacnalpan, July 28, 1890, *Rovirosa* 835 (G, NY). YUCATAN: Tuxpena, Campeche, March 23, 1932, *Lundell* 1431 (F). TERR. QUINTANA ROO: Cozumel Island, Feb. 20, 1899, *Millspaugh* 1551 (F, G).

CENTRAL AMERICA.—BRITISH HONDURAS: Big Creek, April 27, 1929, *Schipp* 190 (F, G, NY, US). GUATEMALA: Vaxactum, Dept. Peten, April 7, 1931, *Bartlett* 12521 (F, US); Vicinity of Puerto Barrios, Dept. de Izabal, June 2–6, 1922, *Standley* 25028 (US). EL SALVADOR: Volcan de San Vicente, Dept. San Vicente, March 7, 8, 1922, *Standley* 21537 (G, US). HONDURAS: San Pedro Sula, Dept. Santa Barbara, May, 1888, *Thieme* (J. D. Smith no. 5650) (G, NY, US); Ceiba, Oct. 18, 1916, *Dyer* A134 (F, G, US). NICARAGUA: Casa Colorado and vicinity, south of Managua, June 27, 1923, *Maxon, Harvey & Valentine* 7421 (G, US). COSTA RICA: 1881, *J. J. Cooper* (Herb. Field Mus. no. 347710, G, U. S. Nat. Herb. nos. 22440, 154190); San Jose, Prov. San Jose, 1887, *J. J. Cooper* (J. D. Smith no. 6018) (US). PANAMA: Pedro Miguel, Jan. 27, 1918, *Killip* 2825 (US); vicinity of El Boquete, Chiriqui, March 2–8, 1911, *Maxon* 4926 (US).

SOUTH AMERICA.—COLUMBIA: Santa Marta, near Onaca, Aug. 22, 1898–1901, *H. H. Smith* 1088 (F, G, NY, US); Vicinity of Medellin, 1911, *Charetier* 33 (NY, US). VENEZUELA: 2½ miles east of Merida, State of Merida, Jan. 23, 1931, *Reed* 210 (US).

10. PTERIDIUM AQUILINUM var. ARACHNOIDEUM (Kaulf.) Herter, Rev. Sudam. Bot. **5:** 21 (1937).[26] PLATE 650, FIGS. 10, 13, 14, PLATE 653, FIG. 3, MAP 12. Illustrations: Vellozo, Fl. Flum. **11:** t. 80 (1827); Christ, Geog. Farne, Fig. 9 (1910), *habitat.*

[26] Combination incorrectly attributed to Baker.

Pteris psittacina Pr. Delic. Prag. **1:** 185 (1822). Although I have not seen Presl's type, his description clearly refers his name to *Pteridium aquilinum* and the locality, Rio de Janeiro, to var. *arachnoideum.* Material recently referred to *Pteridium psittacinum* represents juvenile leaf-forms of var. *arachnoideum* and var. *caudatum.* The leaf-cutting of young plants of these varieties is considerably different from the mature condition and the typical types of pubescence are not developed. *Pteris campestris* Schrad. Gött. gel. Anz. **1824¹:** 871 (1824). *Pteris arachnoidea* Kaulf. Enum. Fil. 190 (1824). *Allosorus psittacinus* (Pr.) Pr. Tent. Pterid. 153 (1836), as *A. psitaccinus. Allosorus arachnoideus* (Kaulf.) Pr. Tent. Pterid. 153 (1836). *Pteris aquilina* L. var. *arachnoidea* (Kaulf.) D. C. Eaton, Proc. Amer. Acad. n.s. **8:** 203 (1861). *Pteris Gardneri* Pr. ex Ettingsh. Denkschr. Ak. Wiss. Wien, **23:** 42 (1864). *Aquilina Gardneri* Pr. ex Ettingsh. Farnkr. 91 (1865), in synonymy. *Pteris aquilina* L. var. *psittacina* (Pr.) Baker in Martius, Fl. Brasil. **1²:** 404 (1870). *Cincinalis arachnoidea* (Kaulf.) Trevis. Atti Soc. Ital. sc. nat. **17:** 239 (1875). *Pteridium aquilinum* (L.) Kuhn var. *esculentum* (Forst.) Kuhn f. *arachnoideum* (Kaulf.) Hieron. Hedwigia **48:** 246 (1909). *Pteridium arachnoideum* (Kaulf.) Maxon, Journ. Wash. Acad. Sci. **14:** 89 (1924). *Filix-foemina aquilina* (L.) Farwell var. *arachnoidea* (Kaulf.) Farwell, Am. Mid. Nat. **12:** 290 (1931). *Pteridium psittacinum* (Pr.) Maxon, Proc. Biol. Soc. Wash. **46:** 141 (1933).

Frond 1–3 m. high, vernation not clearly observed, apparently gleichenioid; stipe usually shorter than the blade; blade 0.5–2 m. long, ovate-triangular to long-triangular in large plants, tripinnate to quadripinnate; costules of the penultimate segments usually pubescent beneath and less so above with short white and also dark or bicolorous hairs, sometimes glabrous; *free lobes present* along the rachis, costae and costules; ultimate segments ovate to linear, the margin often pubescent, the *lower surface arachnoid-pubescent,* rarely appressed-pubescent with short straight hairs, or glabrous, nearly always *having a farinaceous appearance,* the *midnerve* usually *pubescent with dark or bicolorous hairs, membranous wings* usually *present* along the veins and midnerve (PLATE 650, FIG. 14); fertile and sterile indusium ciliate and sometimes also pubescent on the outer surface, or glabrous, the *fertile portion no broader than the sterile* on the same segment; *cells of the sterile indusium small, irregularly arranged* (cf. PLATE 650, FIG. 11).

TYPE: *Chamisso,* probably at Berlin (not seen).

TYPE LOCALITY: Brazil.

Riedel, Brazil, "Ex. herb. hort. Petropolitani" (G) and *Curran* 128, Bahia, Brazil (G, US) differ from typical var. *arachnoideum* in having no free lobes along the rachis, costae and costules.

The following are intermediate between this and var. *caudatum*. *Hitchcock* 17031, Penal Settlement, British Guiana, Dec. 3–9, 1919 (G, US) has free lobes present and a farinaceous appearance, even though glabrous, as in var. *arachnoideum* but has the fertile indusium broader than the sterile as in var. *caudatum*; *Heller* 4468, 14 miles northeast of Mayaguez, Porto Rico, Feb. 1, 1900 (G, F, NY, US) and *Maxon* 4075, San Piedra, Oriente, Cuba, April 14, 1907 (G, US) are similar to var. *caudatum* in characters of pubescence and of the indusium but they have a few free lobes as in var. *arachnoideum*; *Rose & Painter* 7595, Jalisco, Mexico (US) is arachnoid-pubescent but has no free lobes; and *Pennell* 5162, La Cumbre, El Valle, Columbia (US) and *Ariste-Joseph* A207, Bogota, Columbia (US) are arachnoid-pubescent as in var. *arachnoideum* but have the fertile indusium broader than the sterile and have no free lobes as in var. *caudatum*.

Var. *arachnoideum* differs from var. *caudatum* in having free lobes along the rachis, costae and costules rather than not having them; the midnerve is usually pubescent with dark hairs rather than usually glabrous and the fertile portion of the indusium is no broader than the sterile on the same segment rather than broader. Also the lower surface is arachnoid-pubescent rather than appressed-pubescent with straight hairs, the cells of the indusium are smaller and irregularly arranged and membranous wings are usually present on the veins and midnerve beneath rather than usually not present. Even the glabrous phases have a farinaceous appearance beneath.

The differences between var. *arachnoideum* and var. *esculentum*, with which it has often been confused in the past, are discussed under the latter variety.

Var. *arachnoideum* grows on open slopes, in open rocky places, in thickets, forests, grassland, in cleared land and on the edge of forests from the lower elevations up to 3000 m.; and from 300 m. to 700 m. in the Galapagos Islands.

It ranges from the West Indies, Cuba to Trinidad, to southern Mexico, Central America, Galapagos Islands and throughout

South America except the southern portion; also it is apparently absent from most of the Amazon Basin.

West Indies:—Cuba: Monte Verde, Jan.–July, 1859, *Wright* 985 (G); Loma del Gato and vicinity, Sierra Maestra, Aug., 1923, *Hioram & Clement* 6497 (US); Santiago, Santa Ana, March 23, 1902, *Hamilton* 240 (NY). Jamaica: Vicinity of St. Helens Gap, St. Andrew, March 4, 1920, *Maxon & Killip* 619 (F, G, NY, US). Hispaniola: vicinity of Furcy, Haiti, May 26–June 15, 1920, *Leonard* 4339 (G, US); Prov. Monte Cristi, Santo Domingo, June 24, 1929, *Ekman* 12990 (NY, US). Porto Rico: Aug. 28, 1885, *Sintenis* 2658 (G, US). Santa Lucia: Ventine Sulphur Springs (Soufrière), May, 1935, *Box* 449 (US). Trinidad: St. Ann, March 17, 1920, *Britton, Hazen & Mendelson* 676 (G, NY); 1877–8, *Fendler* 77 (G, NY, US).

Mexico.—Mexico: Nanchititla, Temascaltepec, Feb. 14, 1935, *Hinton* 7371 (G, NY). Vera Cruz: Zacuapan, Dec., 1912, *Purpus* 6191 (F, G, NY, US). Guerrero: Montes de Oca, San Antonio-Buenos Aires, May 3, 1938, *Hinton* 14069 (G, US). Oaxaca: Cuicatlan, June 16–22, 1898, *Conzatti & Gonzalez* 748 (G).

Central America.—Guatemala: Volcan de Fuego, *Salvin* (G); Yzabal, Dept. Yzabal, *J. D. Smith* 1565 (G, US). El Salvador: Cerro del Guayabal, Jan., 1924, *Calderon* 2008 (G, US). Honduras: about 15 miles east of Ceiba, Dept. Atlantida, July 21, 1938, *Yuncker, Koepper & Wagner* 8555 (NY). Nicaragua: San Rafael de Norte, March 25, 26, 1917, *Miller & Griscom* 152 (US). Costa Rica: from Vara Blanca to La Concordia, July 23, 1923, *Maxon & Harvey* 8400 (US); 1901–1905, *Werckle* (U. S. Nat. Herb. no. 575231); San Ramon, April, 1913 (Herb. Field Mus. no. 404457). Panama: Vicinity of Monte Lirio, Prov. Chiriqui, June 27–July 13, 1935, *Seibert* 234, in part (G).

South America.—Columbia: Palmira, Dept. El Valle, May 27, 1922, *Pennell & Killip* 6100 (G, NY, US); Santa Marta, Aug. 26, 1898–99, *H. H. Smith* 1091 (NY). Venezuela: Maracai, *Vogl* (G); Island of Margarita, Aug. 28, 1903, *J. R. Johnston* 177 (G); Tovar, 1854–5, *Fendler* 104 (G); 1917, *Curran & Haman* 1111 (G, NY). British Guiana: Malali, Demerara River, Oct. 30–Nov. 5, 1922, *de la Cruz* 2658 (F, G, NY, US); Mt. Iramaikpang, northwest part of Kanuku Mts., April 22, 1938, *A. C. Smith* 3657 (G). French Guiana: Near Cayenne, Oct. 8, 1830, *Leprieur* 100 (F, G, US). Ecuador: Western San Miguel Mts., Oct. 21, 1933, *Schimpff* 247 (F); Andes, 1857–9, *Spruce* 5601 (G, NY); Wreck Bay, Chatham Island, Galapagos Islands, July 6, 1905–6, *A. Stewart* 996 (F, G, NY, US). Peru:

Estrella, Dept. Ayacucho, May 8, 14, 1929 *Killip & Smith* 23095 (NY, US); Cero de Cusilluyoc, Dept. Cusco, May 3–6, 1925, *Pennell* 13936 (G, NY, US); Tarapoto, Dept. San Martin, Dec., 1929, *L. Williams* 5971 (F). BRAZIL: Pará, Nov., 1913, *Petelot* (Herb. Field Mus. no. 593026); Near Petropolis, July 10–16, 1882, *J. Ball* (G); Mt. Itatiaya, vicinity of Monte Serrat, State of Rio de Janeiro, Dec. 31, 1928, *L. B. Smith* 1587 (F, G, NY, US); São Leopoldo, Rio Grande do Sul, *Rick* 24 (G). BOLIVIA: Incachaca, Dept. Cochabamba, Prov. Chapare, Jan. 24, 1929, *Steinbach* 8927 (F, G); Lacotal, Dept. Cochabamba, Prov. Chapare, Feb. 25, 1929, *Steinbach* 9363 (F, G, NY); Tipuani, April, 1920, *Buchtien* 5271 (F, US). PARAGUAY: Y-acá River, Cordillera Centralis, 1900, *Hassler* 6997 (G); Paraná River, 1909–10, *Fiebrig* 6138 (G). URUGUAY: Catalan, Dept. Artigas, Nov., 1927, *Herter* 996 (NY); Pan de Azucar, Dept. Maldonado, Jan. 21, 1912, *Osten* 5688 (US). ARGENTINA: Fontana, Resistencia, Chaco, Feb., 1933, *Schulz* 727 (G); Dept. Punilla, Prov. Cordoba, March 16, 1939, *Dawson* 588 (G); Prov. de Catamarca, Nov. 11, 1910 (U. S. Nat. Herb. no. 1113401).

11. PTERIDIUM AQUILINUM var. ESCULENTUM (Forst.) Kuhn, Chaetopt. 347 (1882). PLATE 650, FIGS. 11, 15, PLATE 653, FIG. 1, MAP 9. Illustrations: Domin, Bibl. Bot. **85**[1]**:** figs. 33, 34 (1914); Schk. Krypt. Gew. t. 97 (1809); Dobbie, New Zealand Ferns, Ed. 3, 183 (1930).

Pteris esculenta Forst. Pl. Escul. 74 (1786). *Allosorus esculentus* (Forst.) Pr. Tent. Pterid. 154 (1836). *Pteris auriculata* Goldm. in Meyen, Nova Acta **19:** supp. 1, 458 (1843). *Pteris aquilina* L. var. *esculenta* (Forst.) Hook. fil. Fl. N. Zel. **2:** 25 (1854). *Cincinalis esculenta* (Forst.) Trevis. Atti Soc. Ital. sc. nat. **17:** 239 (1875). *Ornithopteris esculenta* (Forst.) J. Sm. Hist. Fil. 298 (1875). *Pteridium esculentum* (Forst.) Diels in Engl. & Prantl, Nat. Pfl. **1**[4]**:** 296 (1899). *Pteris aquilina* L. f. *esculenta* Christ in Warb. Monsunia **1:** 68 (1900), without bibliography or reference. *Pteris aquilina* L. f. *caudata* Christ in Warb. Monsunia **1:** 68 (1900), without bibliography or reference. *Pteridium aquilinum* (L.) Kuhn var. *aequipinnulum* Domin, Bibl. Bot. **85**[1]**:** 162 (1914). *Pteridium aquilinum* (L.) Kuhn var. *pseudocaudatum* Domin, Bibl. Bot. **85**[1]**:** 161 (1914), not (Clute) Heller. *Pteridium aquilinum* (L.) Kuhn ssp. *esculentum* (Forst.) Bonap. Notes Ptérid. **4:** 116 (1917).

Frond 0.6–3 m. high, vernation subgleichenioid; stipe about as long as the blade; blade 0.3–1.5 m. long, ovate to triangular, tripinnate to quadripinnate; costules of the penultimate segments glabrous above, glabrous to slightly pubescent beneath with white and often also dark hairs; *free lobes* usually *present* along

the rachis, costae and costules; ultimate segments oblong or usually linear, the margin glabrous, the *lower surface* densely *appressed-pubescent with long, or short, straight hairs, always having a farinaceous appearance*, the *midnerve* usually *glabrous,* sometimes moderately pubescent with white and sometimes also dark hairs, *no membranous wings present* on the veins and midnerve; *fertile and sterile indusium* usually *glabrous,* rarely slightly ciliate, *the fertile portion* usually *no broader than the sterile* on the same segment; *cells of the sterile indusium small, irregularly arranged* (PLATE 650, FIG. 11).

TYPE: *Forster,* location unknown. A fragment of the type "ex Forster Herb." "collected" by L. M. Underwood is at Herb. New York Botanical Garden (seen).

TYPE LOCALITY: Society Islands. Copeland[27] says that: "The sole Tahitian record is that of Forster . . . its absence from all later collections suggests that it does not beseem a wild plant to be edible."

Var. *esculentum* differs from var. *arachnoideum* in its pubescence,—appressed with straight hairs rather than arachnoid,—the absence rather than presence of membranous wings along the veins and midnerve and the midnerve usually glabrous or with white hairs rather than pubescent with dark or bicolorous hairs.

De la Cruz 2658, British Guiana and *Gleason* 423, Tumatumari, British Guiana, June 18–July 8, 1921 (G), var. *arachnoideum,* approach var. *esculentum* in being appressed-pubescent with short hairs.

The differences between var. *esculentum* and vars. *caudatum* and *yarrabense* are discussed under those varieties.

Var. *esculentum* grows in open places, pastures, thickets and clearings, from sea-level up to 1300 m.

It ranges from Australia to the Society Islands.

AUSTRALIA: Sassafras, Victoria, July 3, 1936, *Lothian* (G); Hall's Gap, Grampian Mts., Victoria, Dec., 1912, *Tilden* 848 (F, G); Port Lonsdale, Victoria, Oct.–Nov., 1912, *Tilden* 762 (F, G); Bondi Bay, Sidney, New South Wales, Sept., 1912, *Tilden* 570 (F, G); near Mareton Bay, 1850–51, *Strange* (G); east coast (Nouvelle Hollande), 1845, *Verreaux* 267 (G, US). TASMANIA: *Gunn* (G). NORFOLK ISLAND: 1884, *Metcalfe* (U. S. Nat. Herb. no. 22443). NEW ZEALAND: Whakarewarewa, Nov., 1909, *Leland, Chase & Tilden* 143 (F, G); South Island (Herb. Field Mus. no. 355839); *Craig* (Herb. Field Mus. no.

[27] Copeland, Pteridophytes of the Society Islands. Bishop Mus. Bull. 93, 57 (1932).

596860, G); Taranaki, *Heywood* 56 (G); Mt. Ngongotaka, May–July, 1898, *Prince* (G); North Island (Ex. Herb. T. Kirk) (G). CHATHAM ISLAND: Oct., 1874, *Kershner* (US); Dec., 1874, *Scott* (US). NEW CALEDONIA: (Herb. Field Mus. no. 596487); 1861–67, *Deplanche* 1563 (G); 1874–76, *Germain* (NY). NEW HEBRIDES: Aneiteum, Feb., 1859 (Herb. Field Mus. no. 596565). FIJI ISLANDS: 1860, *Seemann* 809 (G); 1877–78, *Horne* 601 (G); (Herb. Field Mus. no. 593802). NAVIGATOR ISLANDS (SAMOA): 1873, *McAlesber* (NY). SOCIETY ISLANDS: "Ex. Forster Herb." (NY), fragment of type.

12. PTERIDIUM AQUILINUM var. YARRABENSE Domin, Bibl. Bot. **85[1]:** 161 (1914). PLATE 650, FIG. 16, PLATE 653, FIG. 2, MAP 10. Illustration: Domin, Op. cit. fig. 32.

Pteris lorigera Wall. List no. 103 (1829), nomen nudum; isotype at US. *Pteris semihastata* Wall. List. no. 102 (1829), nomen nudum; ex Ag. Rec. Pterid. 48 (1839). *Allosorus lorigerus* (Wall.) Pr. Tent. Pterid. 154 (1836), nomen nudum.

Frond 0.5–3 m. high, vernation not observed; stipe about as long as the blade; blade 0.3–1.5 m. long, ovate to triangular, tripinnate to quadripinnate; costules of the penultimate segments subglabrous above, moderately pubescent beneath with white and rarely also dark hairs; *free lobes* usually *not present* along the rachis, costae and costules; ultimate segments usually linear, sometimes oblong-ovate, the margin glabrous or rarely pubescent, the *lower surface* usually densely *sublanuginose* or rarely arachnoid-pubescent, *not having a farinaceous appearance,* the *midnerve* usually densely *pubescent with white* and infrequently also dark *hairs, no membranous wings present* on the veins and midnerve; the *fertile and sterile indusium* rather densely *ciliate and* usually also *pubescent* on the outer surface, the *fertile portion broader than the sterile* on the same segment, *or no* broader; cells of the sterile indusium small, irregularly arranged.

TYPE: 1910, *Domin,* probably at Praha (not seen).

TYPE LOCALITY: "Nordost-Queensland bei Yarraba."

Var. *yarrabense* differs from var. *esculentum* in having the lower surface of the blade sublanuginose rather than appressed-pubescent with straight hairs, the midnerve on the lower surface of the segments pubescent with white hairs rather than usually glabrous and the fertile and sterile indusium ciliate and pubescent rather than glabrous. Also it does not have a farinaceous appearance beneath and usually does not have free lobes along the rachis, costae and costules.

Strange, Australia, and *Seemann* 809, Fiji Islands, var. *esculentum,* approach var. *yarrabense* in having the fertile and sterile indusium ciliate and the midnerve of the segments slightly pubescent beneath with white hairs.

Ching 5360, Kwangsi Prov., China (NY, US) is intermediate between var. *yarrabense* and var. *Wightianum* and therefore represents an intermediate between ssp. *caudatum* and ssp. *typicum.*

Var. *yarrabense* grows in clearings, thickets, open slopes and at the edge of woods, up to 2500 m. from northern India to Sumatra, east to the Philippine Islands and northeastern Australia.

India: Kumaon, *Blinkworth, Wallich,* 103 (US), isotype of *Pteris lorigera* Wall. French Indo-China: Cochinchine, 1862–66, *Thorel* (Herb. Field Mus. no. 540736); Bokor, Cambodia, Jan. 18, 1926, *H. M. Smith* 288 (G, US). Siam: Koh Chang, April 2, 1924, *H. M. Smith* 197 (US). Federated Malay States: Penang, Dec., 1902 (U. S. Nat. Herb. no. 1097164); Penang (ex Herb. Oldfield) (NY); Larut, Perak, April, 1884, *King's collector* 5926 (US); Tekik Sisih, Pahang, Aug. 19, 1929, *Henderson* (US); Singapore (U. S. Nat. Herb. nos. 22437, 1097181). Anamba Islands: Jemaja, Nov. 4, 1928, *Henderson* 20306 (US). Sumatra: Vicinity of Rantau, Parapot, Bila, March 28–May 10, 1932, *Toroes* 1832 (NY). Philippine Islands: Mindanao, *Clemens* 166 (F); Bucas Island, Oct. 4, 1906, *Merrill* 5264 (US); *Cuming* (U. S. Nat. Herb. no. 853691); *Cuming,* "without a number" (G, NY). British North Borneo: Mt. Kinabalu, Kundasang, April 7, 1932, *J. & M. S. Clemens* 29107 (NY, US); Kuching, Sarawak, *Mjoberg* (NY); Sandakan and vicinity, Sept.–Dec., 1920, *Ramos* 1697 (G, US). Australia: Daintree River, North Queensland, Feb. 29, 1932, *Brass* 2199 (G).

Dubious and Rejected Names

Pteris aquilina L. var. *mexicana* Fée, Mém. Fam. Foug. **9:** 8 (1857), nomen nudum.—Fée in Mém. Fam. Foug. **8:** 114 (1857) described *Pteris aquilina* L. var. *mexicana,* which is clearly *Pteridium aquilinum* var. *caudatum.* In Mém. Fam. Foug. **9:** 8 (1857) he lists *Pteris caudata* L. var. *mexicana,* without reference, but it undoubtedly represents a transfer of his earlier var. *mexicana.* However, he also lists *Pteris aquilina* L. var. *mexicana* which, while it apparently is not the same as his var. *mexicana,* Mém. Fam. Foug. **8:** 114 (1857), cannot be defin-

itely placed without an examination of the collections cited by him: "Orizaba, W. Schaffner (1834) No 136 et (1856) No 468."

Pteris aquilina L. var. *lanuginosa* Fée, Mém. Fam. Foug. **9:** 8 (1857), nomen nudum.—Although probably a synonym of *Pteridium aquilinum* var. *Feei,* this name cannot certainly be placed without an examination of the collection cited by Fée: "W. Schaffner, No 137 Orizaba (1854)."

Pteridium aquilinum longifolium, Am. F. Journ. **1:** 88 (1910).—The publication of this name was an error. It was a new combination based on "*Pteris aquilina longifolium* Hook.", a name taken from sheet number 583 in the Herbarium of the American Fern Society. Dr. L. S. Hopkins informs me that the sheet is actually labeled *Pteris aquilina lanuginosa* Hook. and that *lanuginosa* was misread *longifolium.*

Pteris aquilina L. var. *decipiens* Lawson, Edinb. New Phil. Journ. n. s. **19:** 110 (1864). *Pteridium aquilinum* (L.) Kuhn var. *lanuginosum* (Bong.) Fernald f. *decipiens* (Lawson) Fernald, Rhodora **37:** 248 (1935).—Lawson's name cannot be definitely placed without an examination of the type, which is apparently lost. Lawson says he sent a specimen to D. C. Eaton, but an examination of Eaton's Herbarium at Yale University failed to reveal such a specimen. The name has been placed under var. *pubescens* and if this is correct would take precedence over it as an earlier varietal name. However, there is considerable doubt that the plant in question is var. *pubescens* and I am rejecting the name.

Although the plant was collected in the Gaspé, a likely place for var. *pubescens* to occur as a preglacial relic, and described as lanuginose, authentic material has never been collected in Gaspé Co., Quebec and the remainder of the description: "frond bipinnate, thin and membranous, . . . barren." indicates that the specimen was taken from a young plant. "Lanuginose" may apply to some part of the frond other than the lower surface between the margin and the midnerve. In a footnote Lawson himself says that: "Since the above was written, I have had an opportunity of studying the forms and development of *Pteris aquilina* [this would be var. *latiusculum*] and am quite satisfied that the doubtful plant [var. *decipiens*] is a state of that species, not old enough to be mature."

Pteris aquilina L. var. *glabra* Hook. Sp. Fil. **2:** 196 (1858). *Pteridium aquilinum* (L.) Kuhn var. *glabrum* (Hook.) Luerss. Rabenh. Kr. Fl. Ed. 2, **3:** 107 (1889).—This name includes such a mixture that it cannot be definitely placed in any one variety Hooker placed the following names under it in synoymy: *Pteris aquilina* L. (= var. *typicum*), *Pteris caudata* Schkuhr (= var. *latiusculum* and var. *pseudocaudatum*), *Pteris recurvata* Wall., *Pteris firma* Wall. and *Pteris excelsa* Bl. (= var. *Wightianum*) and *Pteris latiuscula* Desv. (= var. *latiusculum*). His range-citations include the following localities: Europe, Cape of Good Hope (= var. *typicum*), Java (= var. *Wightianum*), Massachusetts (= var. *latiusculum*), New Orleans (= var. *pseudocaudatum*) and Brazil (= var. *arachnoideum*).

EXPLANATION OF PLATES

Plate 650. Fig. 1, Segment of var. *Wightianum,* × 4, pubescence on one half not shown, on part of this half the sporangia and venation are not shown; Fig. 2, Segment of var. *typicum,* × 4, pubescence on one half not shown, on part of this half the sporangia and venation are not shown; Fig. 3, Segment of var. *pubescens,* × 4, pubescence on one half not shown, on part of this half the sporangia and venation and marginal pubescence are not shown; Fig. 4, Segment of var. *Feei,* × 4, pubescence on one half not shown, on part of this half the sporangia and venation and marginal pubescence are not shown; Fig. 5, Segment of var. *decompositum,* × 4, pubescence on one half not shown, on this half the sporangia and venation are not shown; Fig. 6, Segment of var. *africanum,* × 4, no pubescence removed, on part of the segment the sporangia and venation are not shown; Fig. 7, Segment of var. *pseudocaudatum,* × 4, no pubescence removed, on part of the segment the sporangia and venation are not shown; Fig. 8, Segment of var. *latiusculum,* × 4, no pubescence removed, except on part of the segment the marginal pubescence, sporangia and venation are not shown; Fig. 9, Segment of var. *caudatum,* × 4, on part of the segment the pubescence and sporangia are not shown and on another part the venation and farinaceous appearance are also not shown; Fig. 10, Segment of var. *arachnoideum,* × 4, on part of the segment the sporangia and pubescence are not shown and on another part the venation and farinaceous appearance are not shown; Fig. 11, Sterile indusium of var. *esculentum,* about × 75; Fig. 12, Sterile indusium of var. *caudatum,* about × 75; Fig. 13, Farinaceous appearance of var. *arachnoideum,* about × 50, pubescence not shown; Fig. 14, Membranous wings along vein of var. *arachnoideum,* about × 40, pubescence and farinaceous appearance not shown; Fig. 15, Segment of var. *esculentum,* × 4, on part of the segment the pubescence and sporangia are not shown and on another part the venation and farinaceous appearance are not shown; Fig. 16, Segment of var. *yarrabense,* × 4, on one half the pubescence is not shown, and on part of it the sporangia and venation are not shown.

Plate 651. Fig. 1, Middle pinna of var. *Feei,* × ½; Fig. 2, Upper pinna of var. *decompositum,* × ½; Fig. 3, Tip of middle pinna of var. *Wightianum,* × ⅓; Fig. 4, Upper half of middle pinna of var. *typicum,* × ½.

PLATE 652. Fig. 1, Basal pinna of var. *latiusculum*, × ⅓; Fig. 2, Basal pinna of var. *pseudocaudatum*, × ½; Fig. 3, Next to basal pinnule of a basal pinna of var. *africanum*, × ½; Fig. 4, Frond of variant of var. *latiusculum*, × 1/6; Fig. 5, Next to basal pinna of var. *pubescens*, × ⅓.

PLATE 653. Fig. 1, Upper half of middle pinna of var. *esculentum*, × ½; Fig. 2, Basal pinna of small plant of var. *yarrabense*, × ½; Fig. 3, Upper pinna of var. *arachnoideum*, × ⅓; Fig. 4, Tip of frond of var. *caudatum*, × ½.

AN OLD FOREST IN STONINGTON, CONNECTICUT

HUGH M. RAUP

ON November 18, 1939, the writer had occasion to visit, in company with a group of students in Ecology, a piece of old woodland at the mouth of the Pawcatuck River in southeastern Connecticut. The area is of particular interest because it has been considered by some to have been not far removed from a primeval condition. Like so many of our supposed or actual remnants of the virgin forests in southern New England, it suffered great damage during the hurricane of 1938, and there now remains only a battered representation of the once handsome stand of trees.

The late Dr. G. E. Nichols, in describing the virgin forests in Connecticut wrote an account of the tract.[1] Since this account gives an excellent picture of the forest, and since such descriptions now take on rather more historic interest than they had before the hurricane, it seems worth while to quote Dr. Nichols in full.[2]

"Southeastern Connecticut, so far as ascertained, possesses only one possible fragment of original forest and, notwithstanding the owner's assurance that the area has never been cut over, the writer must confess to some doubt as to the primeval nature of the tract. The area in question, some 40 acres in extent, occupies a low hill bordering the Sound at the mouth of the Pawcatuck River in the town of Stonington. In contrast to the forests heretofore described there is a complete absence of hemlock, beech, sugar maple, yellow birch, pine, and even chestnut. The character trees are white oak and black oak (*Quercus velutina*), especially the former, associated with which are shagbark hickory and red maple. The stand is of a more open character than in any of the areas previously mentioned and in general aspect the forest resembles the climax oak-hickory type of the Chicago region.

[1] Nichols, G. E. "The Vegetation of Connecticut" II, Torreya **13**: 214–215 (1913).

[2] No photograph of the Stonington tract was published by Dr. Nichols. The writer is indebted to Dr. H. J. Lutz of the School of Forestry at Yale for making a thorough, though unavailing, search in Dr. Nichols' files for any photograph that the latter may have had.

Trees with a diameter of from 45 to 60 centimeters are common. The ground is not deeply shaded and the low, dense underbrush is quite xerophytic, being composed largely of *Gaylussacia baccata, Vaccinium corymbosum, Vaccinium stamineum,* and *Corylus americana.* It is of course not impossible that the xero-mesophytic nature of the tract is due to its extremely exposed location and that it really represents a virgin forest. Moreover it must be borne in mind that in general the forests of eastern Connecticut are less mesophytic than are those in other parts of the state."

At the time of the writer's first visit, the loggers were actively engaged in clearing out the tangle of fallen stems and branches which resulted from the hurricane. Nearly all of the tract was destroyed, leaving only a few scattered trees on the north, or landward side. A considerable number of logs of fair quality were being taken out, leaving newly cut stumps upon which ring counts could be made. In the short time available only eleven stumps were counted, ranging in number of rings from 110 to 136. Two facts were apparent: first, the trees all showed relatively wide rings in their early period of growth; and second, their average age was approximately 123 years which was the length of time between the hurricane of 1815 and that of 1938.[1] Since they were among the largest and oldest trees in the stand there seemed some evidence that Dr. Nichols' chariness about considering the forest to be entirely unmodified might be well founded. The spread in ages among the trees remained to be explained, however, and it was especially desirable to find some more conclusive evidence of an actual release which could be attributed to a cataclysm similar to that of 1938.

With these problems in mind, the tract was visited again in May, 1940. The logging operations were then nearly completed, and many more stumps were available. Fifty-one were counted on this occasion, all of them solid, or nearly so, to the core, and cut from one to three feet above the base. Most of them may be divided roughly into two age groups. The smaller of these consists of five trees, all of which contained over 140 clearly visible rings. All of these showed a distinct release, indicated by a more or less sudden widening of the rings, immediately after 1815. The larger group, as indicated by the earlier observations, con-

[1] Channing, Walter (Editor). New England Hurricanes, 1635, 1815, 1938. Boston, 1939. Brooks, Charles F. Hurricanes into New England: Meteorology of the Storm of September 21, 1938. Geog. Rev. **29**: 119–127 (1939).

sisted of 41 trees in which, judging by field observations, no obvious release was evident near the center. In the case of those with ages under 123 years none could be expected if the 1815 hurricane were significant; but some 21 individuals showed ages ranging between 124 and 140, and might be expected to have experienced a release after 1815.

There is no way of knowing how many years must be added to the count for each tree to round out its full life, unless each could be dissected to the very base. If, however, a release in 1815 is accepted, then it is to be expected that seedlings and small trees existing at that date had previously been suppressed in greater or less degree depending upon their ages and local positions in the ancient forest. Counts were made on two small trees in the advance growth under the forest which was blown down in 1938. Both of these were young white oaks, growing in the shrubby cover of *Gaylussacia, Vaccinium,* and *Corylus.* One of them, 2 feet high, had a stem only about six inches long and about one half an inch in diameter. The other was four feet tall, with a stem about two feet long, and a diameter of about five-eighths of an inch at the base. The first proved to be twenty-nine years old, and the second sixteen years. In both the rings were so close together and confused that microscopic sections had to be made before good counts were possible[1]; and both showed a sudden release after 1938. That is, there was one unusually wide ring at the outside which constituted the growth of 1939.

Two suggestions are to be derived from these observations. One is that about half of the trees blown down in 1938 began as seedlings or sprouts immediately after 1815, or were present as suppressed advance growth in a forest which existed prior to 1815, and were released at that time. Second, the absence of a release in the 21 trees showing 123 to 140 rings may be due to a certain amount of clearing prior to 1815. At the margins of the tract there are some areas that have been pastured considerably, with grassy glades and a partial cover of blackberry bushes. Old white-oaks growing in these spots showed no release in 1815, indicating that similar conditions may have existed at that time, possibly more widespread than subsequently.

The five older trees, which showed a definite release, had at-

[1] The writer is indebted to Mr. F. C. Barghoorn for cutting these sections.

tained such size in 1815 as to have reached up into better light and to have begun to put on more wood with more clearly defined rings each year. The oldest of the five showed about 180 rings on the stump to which must be added a considerable number for the years required to reach stump height. The rings nearest the center were, as would be expected, very small, but there followed a period of gradual increase to 1815 when the tree was about six inches in diameter. After the sudden release of 1815 it began to put on wood much faster. All of these five old trees had minute rings near the center, clearly indicating suppression. There seemed to be no close relationship between the diameter of the trees and their age. Some that were 12 to 15 inches in diameter were fully as old as those two feet or more in diameter.

Another observation which bears out the theory that the 1815 hurricane was responsible for a great amount of damage is that the older trees counted, that is, those which had attained some size by 1815 and were reaching toward the canopy, were all on the landward side of the tract where they would not be subject to quite so much wind as those nearer the shore line. It has already been noted that the remnants of the last hurricane are for the most part on the landward side.

This study indicates that the old oak-hickory wood at Stonington was far from unmodified prior to the hurricane of 1938; that it was seriously damaged in 1815, presumably by the hurricane of that year; and that its canopy had been partially opened before 1815. There is also the suggestion that in spite of the early clearing, and in spite of devastating destruction in 1815, it did not change much in its hardwood composition. The existence of advanced growth of white oak, black oak, hickory, and red maple, suppressed because of a dense canopy prior to 1815, suggests that the trees in that canopy were not far different from those which were destroyed recently. An alternative hypothesis would be that prior to 1815 there had been some very old second growth or primeval forest of other facies which might have created a habitat similar to that which now appears in our old field white pine or red cedar stands. Such a primeval forest is not consistent, however, with the early accounts of the coastal vegetation in this

region, which describe forests of oaks, hickories, and chestnuts.[1] Furthermore, it does not seem at all likely that in a growing colony along the coast, farm-land could have been cleared, used, and abandoned so long prior to 1815 as to give rise to old-field stands which could have created such a habitat.

Between 1815 and 1938 there is no evidence of release cutting. There are no sudden breaks in the development of wood except for occasional periods of very slow growth, probably due to dry or cold seasons. One such period occurred about 1890, and lasted for three or four years.

Arnold Arboretum
Harvard University.

Remarks on the Name Phlox nivalis.—In Rhodora xlii. 476 a question is raised as to the validity of the name *Phlox nivalis* as applied to the subulate-leaved species of the southeastern Coastal Plain and Piedmont. While this name, when proposed by Loddiges, was not accompanied by an adequate description, it was validated by Sweet in Brit. Flow. Gard. ii. no. 185 only four years later. The latter author published a more faithful representation of the habit of the plant than had been given by Loddiges' crude plate, and also an accurate drawing of the floral parts. His text included a detailed english description and a latin diagnosis, so that all requirements are fulfilled.

Nuttall's name *P. Hentzii* was not published until seven years later, and his diagnosis was not so full as that of Sweet. A sheet in the herbarium of the Academy of Natural Sciences of Philadelphia bears an annotation by Nuttall which shows that he was familiar with the earlier name, but he failed to mention this when he proposed his new one. Under our present rules of nomenclature Nuttall's name is to be rejected as superfluous when published, and the plant should be known as *Phlox nivalis* Lodd. ex Sweet.—Edgar T. Wherry, University of Pennsylvania.

[1] For reviews of early descriptions of southern New England Forests see Bromley, Stanley W. *The original Forest Types of Southern New England*, Ecol. Monog. **5**: 61–89; and Raup, H. M. *Recent Changes of Climate and Vegetation in Southern New England and Adjacent New York*, Jour. Arn. Arb. **18**: 79–117.

REAPPEARANCE OF RARE NEW ENGLAND MARINE ALGAE

WM. RANDOLPH TAYLOR

SPORADIC occurrences of marine algae are often more puzzling to botanists than would have been the case had the plants belonged to the land flora. It is notably more difficult to picture comprehensively the distribution of marine species, to locate small isolated colonies and, from lack of detailed knowledge of the sea bottom to differentiate physiographic from climatic limitations of range, particularly if the plants are rare, or at least rarely reported. The writer, having rather intensively observed a considerable area about Woods Hole, Massachusetts for over twenty years, has seen a number of reappearances of forms but once, or seldom, reported previously. It seems improbable that the plants have been abundantly present during the intervening years but remained undetected; they may have persisted as scattered individuals vegetatively propagated, or they may have been reintroduced from outside the area.

The current season has provided two notable examples. On landing at Gay Head, Marthas Vineyard, on July 10th, 1940, the writer almost immediately noticed on the sand an alga not previously found by him, but recognized as *Platoma Bairdii* (Farlow) Kuckuck. With the help of his class, there collecting algae for study, he secured several specimens and returned a week later for more. Altogether, many score specimens were brought back and preserved. Farlow (1875, p. 372) described[1] the plant as *Nemastoma ? Bairdii* on one small tetrasporic piece, and it has not been found in America in the interval; the next significant report[2] is that of Kuckuck (1912, p. 189) who made the present combination after finding more ample material off Helgoland and studying the asexual and sexual material thoroughly. The writer has not noticed sexual plants in the new Gay Head material, but it is richly tetrasporiferous. Here, then, is a species but once seen, reported again in great abundance after nearly 70 years of probable absence from the type locality

[1] Farlow, W. G. 1875. List of the Marine Algae of the United States with notes of New or Imperfectly Known Species. Proc. American Acad. Arts and Sci., **10**(11): 351–380.

[2] Kuckuck, P. 1912. Über Platoma Bairdii (Farlow) Kuckuck. Wiss. Meeresuntersuch., N. F., Abt. Helgoland, **5**(3): 189–210.

in an area inspected annually (for more than two decades) by dredging and shore collecting.

On the same day the Platoma came to light, one of the party brought to the writer in the field a small brown specimen which was easily distinguished as *Tilopteris Mertensii* (J. E. Sm.) Kütz., which he[3] had found in dredging off the same shore in 1931 (Taylor in Lewis and Taylor 1933, p. 151). On the first occasion two or three small pieces were found; on this there were several good specimens, all sporangial as before. There were none to be had at the same place a week later. Both Platoma and Tilopteris were washed ashore, but their normal habitat is on rocks in relatively shallow water. No plants were secured in 1940 when dredging nearby. With them was another species, rare in the region, which appeared in some abundance, namely *Gloiosiphonia capillaris* (Huds.) Carm. This the writer has only found on one or two earlier occasions.

A few words regarding other plants recognized as recently new to the district, or rare, may be pertinent. The Phaeophycean *Acrothrix novae-angliae* Taylor, first seen in 1925 and described[4] in 1928 (Taylor 1928, p. 577) has persisted and become more common, particularly during the current season. In 1934 the writer found[5] the tropical *Sargassum fluitans* Børg. washed ashore on Nonamesset Island (Taylor 1937, p. 211). The better known *S. natans* (L.) J. Meyen has frequently been reported, probably blown out of its usual path in the current of the Gulf Stream. We may add to these as a rare visitor to the coast *S. Hystrix* var. *buxifolium* (Ch.) J. Ag., which the writer found on the south side of Nantucket Island on the 17th of July 1938, associated with both of the above mentioned species. Among Rhodophyceae *Trailiella intricata* (J. Ag.) Batt. (Drew and Hof in Lewis and Taylor 1928, p. 196) has not continued as abundant as it was about 1930, but from 1927 to the present has turned up each summer, sometimes rare but generally in moderate amount. *Asparagopsis hamifera* (Har.) Okam. has continued in the flora,

[3] Lewis, I. F. and Taylor, W. R. 1933. Notes from the Woods Hole Laboratory, 1932. Rhodora 35: 147–154.

[4] Taylor, W. R. 1928. A Species of Acrothrix on the Massachusetts Coast. Amer. Jour. Bot., 15: 577–583.

[5] Taylor, W. R. 1937. Marine Algae of the Northeastern Coast of North America. vii + 427 pp., 60 pl. Ann Arbor.

with less fluctuation (Taylor in Lewis and Taylor 1928, p. 197).[6] *Plumaria sericea* (Harv.) Rupr. (Taylor 1937, p. 330)[5] and *Phycodrys rubens* (Huds.) Batt. (Taylor 1937, p. 351)[5] have occasional seasons of relative frequency, but are generally very scarce. *Lomentaria orcadensis* (Harv.) Coll. (Taylor 1937, p. 309) was rarely reported, but for two or three years about 1931 it was very frequent in shallow water at several stations; it now has not been seen for some years. *Scinaia furcellata* (Turn.) Biv., considered not rare by Davis about 1911 at suitable places, is only found at rare intervals in small pieces. Among Myxophyceae *Brachytrichia Quoyii* (C. Ag.) Born. & Flah. also is sporadic, having been seen here three times in over twenty years, tending to return in the old localities.

University of Michigan.

Nymphaea tetragona in Somerset County, Maine.—While on Waterfowl Survey work for the Maine Department of Inland Fisheries and Game, the writer with Virgil S. Pratt found *Nymphaea tetragona* Georgi in three localities in Somerset County. Previous reports of this plant for the State are by Wayne E. Manning, who found it in Chase Brook at Portage Lake[1], and by Olof O. Nylander, who reported it at Salmon Brook Lake Bog in Perham[2] and in Mosquito Brook at Portage Lake.[3] These stations are all in Aroostook County.

In Attean Pond in the town of Attean near the mouth of Moose River the plant was found scattered over several acres of open water, associated with *Potamogeton natans* L. and *Polygonum natans* A. Eaton. The water was about four feet deep over a bottom of firm mud; it had a pH of 7.0. Specimens of this collection will be deposited in the herbarium of the University of Maine and in the herbarium of the New England Botanical Club. In addition scattered plants were found in Dennistown. These were in Branch Stream, which flows into Little Big Wood

[6] Lewis, I. F. and Taylor, W. R. 1928. Notes from the Woods Hole Laboratory, 1928. Rhodora, **30**: 193–198.

[1] Manning, Rhodora **38**: 375, 1936.

[2] Nylander, Contribution to Free Booters Club of Knowledge, Caribou, Maine, January, 1938.

[3] Nylander, Presque Isle Star-Herald, November 21, 1940.

Pond. A few plants were also seen in Holeb Pond in the town of Holeb.

Dr. E. C. Ogden of the University of Maine verified the writer's identification.—J. S. Gashwiler, Department of Inland Fisheries and Game, Augusta, Maine.

Deam's Flora of Indiana.[1]—Dr. Deam's Flora of Indiana has been long awaited. Its preparation has involved forty years of collecting and observation throughout the state, the accumulation of one of the largest and best private herbaria ever got together in this country and of a library of like scope and excellence, and unremitting vigilance in checking detail and in keeping abreast of current taxonomic developments. Those who knew this and were familiar with the author's previous publications had formed high expectations of the Flora. They will not be disappointed.

It has about everything yet thought of which a good local flora should have—an introduction giving physiographic information; an abundantly annotated list, arranged according to the Engler & Prantl system, of the 2530 species and varieties admitted and the 707 rejected records; a glossary, statistical summary, bibliography, etc. Its taxonomy in a few critical groups has been contributed by specialists and in others rests on their determinations, but is enriched by an occasional original study or critical comment out of the author's own experience; and its keys are largely original and made up from Indiana material. Less usual, but equally commendable, features are: a list of obsolete place-names, and one of collectors who have worked in Indiana, giving dates of birth and death when available, areas in which the collections of each were chiefly made, herbaria in which specimens are preserved, and the number of each collector's specimens seen, even when that number is only one.

The general plan of the work is familiar enough; its distinction lies, not in any innovation, but in the high quality of its execution. There is constant and successful striving after clarity; all terms and methods used are explained with extreme care. There is, as Prof. Coulter points out in his foreword, an unusual wealth of ecological data for all species, as to soils, types of forest, associated species, and the like. And this and a great mass of other detail are set forth clearly and systematically.

If, with all this care, functioning in one minor matter, the orthography of English names, is not perfect; if Dr. Deam has failed to achieve consistency therein[2] and has occasionally admitted such orthographic and grammatical monstrosities as "Smallflower Sweetbrier," he is no worse off than many others of us. Perhaps no one but the present reviewer will notice these minutiae anyway. Nevertheless, it would have been

[1] Deam, Charles C. Flora of Indiana. Indiana Department of Conservation, Indianapolis. June, 1940. 1236 pp., 1 pl. 2247 maps. $3.50, at the State Library, Indianapolis.

[2] For instance: Curly Wildginger (p. 403), Blue Wild-indigo (591), Trailing Wild Bean (622); Crested Woodfern (48), Violet Wood Sorrel (627); Green Adder's Mouth (349), Green Adder's-mouth (1167); Few-flowered Spikerush (204), Large-flower Sensitive Plant (587).

gratifying if, as one detail of a major enterprise, he could have worked out a better balanced system, more consonant with the best existing usage.

In publishing the Flora, the Department of Conservation of Indiana has happily not limited Dr. Deam as to space and has turned out a neatly bound volume, with handsome typography. Some rather egregious printer's errors, such as repeating the line containing the name *Dryopteris Goldiana* in the place where *D. cristata* ought to be, have, however, slipped by and seem particularly glaring in a work so meticulously careful in nearly every detail under the author's control.

There can be no question of the lasting importance of this Flora in its field. Few have been so well done. It will long serve students of floristics and distribution as an abundant source of reliable information; and (like Brendel's Flora Peoriana, which Dr. Deam once told me he had taken as his own model) it sets a standard of excellence for authors of future local floras to live up to—if they can.—C. A. Weatherby.

A New Form of Bromus inermis.—Hungarian or smooth brome-grass is distributed throughout Minnesota as a cultivated crop and as an intruder along roadsides.

In the fall of 1938 a specimen of *Bromus inermis* Leyss. which exhibited a peculiar bulbiferous state was submitted to me by Mr. Clemens Kaufman. This appears to be a new form and is being proposed as such at this time.

Bromus inermis Leyss. forma **bulbiferus,** forma nova. A forma normali differt inflorescentiis bulbillos gerentibus.

In this form some of the florets are replaced by bulbils. This state is similar to that well known condition in *Poa alpina* L.[1]

The type was collected on Cleveland Avenue four miles north of the campus of Minnesota College of Agriculture, Ramsey County, Minnesota, October 11, 1938. The type is deposited in the University of Minnesota Herbarium.—John W. Moore, University of Minnesota.

[1] *Poa alpina* L. forma *vivipara* (Willd.) Scribner & Merrill. Contrib. U. S. Nat. Herb. 13: 68, June 8, 1910.

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JOURNAL OF

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ADDITIONS TO THE FLORA OF FISHERS ISLAND, NEW YORK

Harold St. John

About two miles off the coast of Connecticut, near New London, is a long, wooded island, Fishers Island. Though remote geographically, it is within the political boundaries of Suffolk County, New York. The island is seven miles in length, with an extreme width of one and one half miles and an average width of one half a mile, and its highest hills are 110 and 120 feet in height. There are salt ponds, salt marshes, sandy or gravelly beaches, several fresh ponds, and the rolling, hilly uplands which have a dense but wind-swept scrub or forest.

Published accounts of the botany of Fishers Island are few. Those known to the author are the following, arranged chronologically:

Graves, C. B. Notes from Plum Island and Fisher's Island, N. Y. Bull. Torrey Bot. Club xxiii. 59 (1896).

Evans, A. W. A New Station for Coelopleurum actaeifolium. Torreya xvii. 103 (1917).

Evans, A. W. The Hepaticae of Fisher's Island. Torreya xxvi. 85–86 (1926).

Hanmer, C. C. Plants of Fishers Island. Torreya xl. 65–81 (1940).

The last publication gives the common name, the scientific name, and often the abundance of about 500 species of vascular plants. These are the records of thirty years of collecting by Mr. Hanmer who has long maintained a summer home on the island.

He refers to the disappearance of numerous species due to draining. It is obvious that the recent development of numerous estates, summer homes, hotels, country clubs, etc., have much restricted the native flora.

The writer here presents a supplement to Hanmer's list of the vascular flora, based upon his own collections and upon published records. It is probable that other records may be found in the C. B. Graves herbarium at Connecticut College, New London, which the writer has not had an opportunity to examine.

In 1920 from August 10th to the 13th the author collected on the western end of the island while visiting at the army post, Fort H. G. Wright. This 1920 collection was made in behalf of the Gray Herbarium, so was left there when the collector resigned to accept a position at the State College of Washington. C. A. Weatherby kindly determined this collection. His determinations are used here, except when modified owing to more recent nomenclatorial changes. On September 21, 1939, the author had three hours on the island with an auto for transportation. The collections made on these two short visits total 238 species. Of these 75 are not included by Hanmer. They are listed below. Various other species common to Hanmer's and the author's collections have been distributed with different specific names. In general, he followed the names in Gray's Manual, ed. 7, while the author has endeavored to use all corrections or later changes that are valid. These nomenclatorial divergencies are not included here, as the initiated can readily check them. The author's collections are deposited in the Gray Herbarium, with duplicates in several other eastern herbaria. In the following list is given the scientific name of each species and the author's collection number which represents it.

OSMUNDACEAE

Osmunda regalis L. var. spectabilis (Willd.) Gray, 2523.

EQUISETACEAE

Equisetum arvense L. forma nemorosum Braun, 2525.
Forma decumbens (G. F. W. Meyer) Klinge, 2526.

LYCOPODIACEAE

Lycopodium obscurum L., 20058.

Pinaceae

Juniperus virginiana L. var. crebra Fern. & Grisc., 2535. It is probable that the collections recorded by Hanmer as the species belong to this recently described northern variety.

Najadaceae

Zostera marina L., 2545.

Alismataceae

Sagittaria Engelmanniana J. G. Sm., 2547.

Gramineae

Agropyron repens (L.) Beauv. f. pilosum (Scribn.) Fern., 2550.
Agrostis perennans (Walt.) Tuckerm., 2551.
Andropogon scoparius Michx. var. frequens Hubb., 20039; 20097.
Var. septentrionalis Fern. & Grisc., 20061.
Glyceria striata (Lam.) Hitchc., 2560.
Panicum meridionale Ashe var. albemarlense (Ashe) Fern., 2569; 20041.
P. microcarpon Muhl., 2571.
P. virgatum L. var. spissum Linder, 2568; 20080.

Cyperaceae

Cyperus filiculmis Vahl var. macilentus Fern., 2595.
Eleocharis parvula (R. & S.) Link, 2610.

Araceae

Symplocarpus foetidus (L.) Nutt., 2619.

Juncaceae

Juncus effusus L. var. solutus Fern. & Wieg., 2628.
J. marginatus Rostk., 2629.
J. macer S. F. Gray, 2635.

Liliaceae

Smilax glauca Walt. var. leurophylla Blake, 2645.

Salicaceae

Populus alba L., 2663, introduced.
P. grandidentata Michx., 2662.
P. tremuloides Michx., 2664.
Salix discolor Muhl., 2670.

Myricaceae

Comptonia peregrina (L.) Coult. var. asplenifolia (L.) Fern., 2674.

Juglandaceae

Carya glabra (Mill.) Spach, 2678.

Betulaceae

Alnus incana (L.) Moench., 2683.
Betula populifolia Marsh., 2687.

Fagaceae

Quercus velutina Lam., 2693.

Polygonaceae

Polygonum Convolvulus L., 2701, introduced.
P. Hydropiper L. var. projectum Stanf., 20092.
P. pensylvanicum L. var. laevigatum Fern., 20071.

Chenopodiaceae

Salsola Kali L. var. caroliniana (Walt.) Nutt., 2710.

Caryophyllaceae

Arenaria peploides L. var. robusta Fern., 20066.

Cruciferae

Brassica kaber (DC.) L. C. Wheeler, 20085, introduced.

Droseraceae

Drosera rotundifolia L., 2732.

Rosaceae

Agrimonia striata Michx., 2737.
Potentilla canadensis L. var. typica Fern., 2743.
P. pacifica Howell, 20074.
P. simplex Michx. var. calvescens Fern., 2742.
Rubus ostryifolius Rydb., 2756.

Leguminosae

Lathyrus japonicus Willd. var. pellitus Fern., 2773.

Euphorbiaceae

Euphorbia glyptosperma Engelm. fide Graves, C. B. (Bull. Torrey Bot. Club xxiii. 59, 1896), and Gray, A. (Man. Bot. ed. 7, 546, 1908).

ANACARDIACEAE

Rhus copallina L. var. latifolia Engler, 2790.

AQUIFOLIACEAE

Ilex verticillata (L.) Gray var. tenuifolia (Torr.) Wats., 2793.

VITACEAE

Vitis labrusca L., 2811.

GUTTIFERAE

Hypericum mutilum L. var. parviflorum (Willd.) Fern., 20099.

VIOLACEAE

Viola pallens (Banks) Brainerd, 2813.

ONAGRACEAE

Circaea latifolia Hill, 2825.
Ludwigia palustris (L.) Ell. var. americana (DC.) Fern. & Grisc., 20101.

UMBELLIFERAE

Cicuta bulbifera L., 2832.
Coelopleurum lucidum (L.) Fern. Reported (as C. *actaeifolium*) by Evans, A. W. (Torreya xvii. 103, 1917).
Hydrocotyle sp. A sterile collection, 20059, proved inadequate for specific identification.
Sium suave Walt., 2837.

ERICACEAE

Gaylussacia frondosa (L.) T. & G., 2849.
Kalmia angustifolia L., 2853.
Rhododendron viscosum (L.) Torr., 2863.

PRIMULACEAE

× Lysimachia producta (Gray) Fern., 2870.

CONVOLVULACEAE

Cuscuta pentagona Engelm., 20090.

LABIATAE

Monarda didyma L., 2890.
Prunella vulgaris L. var. lanceolata (Barton) Fern., 2891.

SOLANACEAE

Datura Stramonium L., 20076, introduced.

PLANTAGINACEAE

Plantago elongata Pursh was reported by Graves, C. B. (Bull. Torrey Bot. Club, xxiii. 59, 1896).

RUBIACEAE

Mitchella repens L., 2920.

COMPOSITAE

Ambrosia artemisiifolia L. var. elatior (L.) Descourtils, 20073.
Aster paniculatus Lam. var. simplex (Willd.) Burgess, 20047.
A. pilosus Willd., 20083.
Bidens connata Muhl. var. petiolata (Nutt.) Farw., 20098.
Erechtites megalocarpa Fern., 20053. This is a range extension, westwards from Buzzards Bay, Mass.
Helianthus annuus L., 20044, introduced.
Lactuca canadensis L. var. latifolia Kuntze, 2956.
Xanthium italicum Mor., 20050, introduced.

OSBORN BOTANICAL LABORATORY, YALE UNIVERSITY,
New Haven, Connecticut

THE PUBESCENT FORM OF CEANOTHUS OVATUS

J. H. SOPER

WHILE determining and mapping the distributions of some plants in my Southwestern Ontario collections of 1940, I came upon a set of plants which were clearly the pubescent extreme of *Ceanothus ovatus* Desf., first described by Torrey and Gray.[1] This has been passing in most Floras and Manuals as var. *pubescens* Torr. and Gray, but a study of the nomenclature shows that the correct varietal epithet is var. *pubescens* Watson. The facts disclosed by the investigation are here briefly summarized.

Unfortunately when Torrey and Gray described the pubescent phase of *Ceanothus ovalis* Bigel.[2] they did not give it a name, thus rendering the publication incomplete. In 1862 Engelmann took up the Torrey and Gray plant as distinct, for in his *Plants of the Upper Missouri* there is listed a *Ceanothus ovalis*, var. *pubescens*.[3] Although no reference is given to the Torrey and

[1] Fl. N. Amer. **1**: 265 (1838)—"β.? leaves (especially on the veins), young branches, and peduncles pubescent."

[2] Fl. Bost. ed. 2, 92 (1824). This name was later replaced by the earlier *C. ovatus* Desf. Arb. **2**: 381 (1809).

[3] Trans. Amer. Phil. Soc. n. s. **12**: 187 (1862).

Gray description, there is little doubt that the plant in question was the same and that Engelmann was aware of the description. As far as I have been able to determine, the first writer to bring together both the description and the name is Sereno Watson.[4] He cited the Torrey and Gray reference and also the Engelmann reference, and in addition placed the variety under the correct binomial *C. ovatus* Desf. For this reason the correct name of the pubescent extreme of *Ceanothus ovatus,* when given varietal rank, should be var. *pubescens* Watson.

Distribution-maps of both *C. ovatus* and the pubescent extreme were made from the representative material in the Gray Herbarium. These showed that the pubescent phase, which has generally been considered as having a more western distribution, occurs within the range of the species even as far east as the Great Lakes and northeastern Massachusetts. Since this pubescent extreme does not have definite claim to rank as a geographic variety, I am considering it as merely a pubescent form. The essential bibliography is as follows:

Ceanothus ovatus Desf., forma **pubescens** (Wats.), stat. nov. *C. ovalis* Bigel., β.? Torrey and Gray, Fl. N. Amer. **1:** 265 (1838). *C. ovalis,* var. *pubescens* Engelmann in Pl. Upp. Miss. 187 (1862), nomen nudum. *C. ovatus,* var. *pubescens* Watson, Bibl. Ind. 166 (1878); Trelease in Proc. Calif. Acad. Sci. 2nd. ser. **1:** 108 (1889); and later authors, wrongly ascribed to Torr. & Gray. *C. pubescens* ("T. & G.") Rydberg in Small, Fl. Se. U. S. 751, 1334 (1903); not Ruiz & Pavon, Fl. Peruv. **3:** 6, pl. 228 (1802).

Gray Herbarium.

Sparganium glomeratum in Minnesota.—A colony of *Sparganium glomeratum* Laest. occurs in Duluth, Minnesota. It is located on Minnesota Point in Sec. 19, in a shallow bog formerly connected with Superior Bay. Cushioned in *Sphagna* in a *Calla-Acorus* association the plants grow in water from a few to several inches deep, depending on the fluctuating bay level.

The Duluth colony occasioned much interest to the author whose collections Nos. **1627** and **1703** were distributed as *S. fluctuans.* Dr. John B. Moyle's annotation of the sheets in the University of Minnesota Herbarium as *S. fluitans* Fries, the

[4] Bibl. Ind. 166 (1878).

occurrence of which in America was unknown to the author at that time, led to further study of the material in living and dried states.

The Duluth plants have a sparse and delicate root development with slender rhizomes, apparently different from European plants which are more robust with thicker roots and rhizomes. Moreover, the fruiting heads in the Duluth plants are usually four, sometimes three, whereas in the plants from Sweden and Finland they are usually five, rarely three or six. However, a careful comparative study of flowers and fruits was conclusive as to identity of the Duluth collections.

Regarding the status of this species Professor M. L. Fernald kindly furnished the following critical statement: "*S. glomeratum* Laest. (1852) is regularly kept up by the European authors. It was maintained by Graebner, is also maintained in Holmberg's edition of Hartman's Handbok i. 78 (1922) and in Lindman's Svensk Famerogamflora 44 (1918), both Lindman and Holmberg stating that *S. fluitans* Fries was a mixture or *nomen confusum,* standing primarily upon *S. affine* Schnitzl. (1845) which, as I have repeatedly shown, is *S. angustifolium* Michx. (1803)." Furthermore, Prof. Fernald concludes: "Since the Scandinavian authors so generally reject *S. fluitans* as a *nomen confusum* and cling to *S. glomeratum*, it seems to me wiser to follow their interpretation."

Pertaining to the occurrence of *S. glomeratum* in America, according to Prof. Fernald the species was reported by Dr. Harrison F. Lewis from the Natashaquan River region of Saguenay County, Quebec in Canadian Field Naturalist xlv. 178 (October, 1931). Meinhausen's statement in part, "Aus Nord-America . . ." in Mel. Biol. Acad. St. Petersbourg XIII. (1893) 389, is based upon *S. simplex* Huds. var. *fluitans* Engelm., synonymous with *S. fluctuans* (Morong) Robinson.

In addition to the Duluth specimens there is a single sheet in the University of Minnesota Herbarium labeled as follows: "Lake Ithasca, Minn., July 1893. A. B. Aiton." Obviously the locality is Lake Itasca where the plants have not been discovered since.

The author is indebted to Dr. H. A. Gleason, New York Botanical Gardens, and to Dr. C. O. Rosendahl, University of

Minnesota for herbarium and library facilities; to Dr. F. J. Hermann, Bureau of Plant Industry for checking distribution data; to Prof. M. L. Fernald for the needed data on the specific status and records of distribution.—Olga Lakela, State Teachers College, Duluth.

TERATOLOGIC TYPHA

Harold St. John

The occasional finding of an abnormal specimen of some well-known plant is an incident of decided interest to the collecting botanist. From that time on, he watches with keener eyes for a repetition of similar monstrosities within that particular species, and soon he can add it to his list of those species which commonly produce teratologic individuals. All of us have such a list of a score or more names, often it is only a mental list, but it is nevertheless available for quick and ready reference. A record of some of these observations may prove of great value to those active in tracing the phylogeny of the species.

During the latter part of August and early September, 1917, Miss Grace M. Bryant noticed and collected some Cat-tails that were decidedly out of the ordinary. Nearly all of these are shown in the accompanying photograph. On September 14th Miss Bryant and the author visited the locality together. It is along both banks of Alewife Brook between Massachusetts Avenue and the first bridge, a railroad bridge, a quarter of a mile distant to the south. The stream here forms the boundary between Cambridge and Arlington. Both Cat-tails, *Typha latifolia* L. and *T. angustifolia* L., occur here along the banks of the sluggish stream, but the latter predominates often forming a continuous fringe.

Three abnormal plants of *T. latifolia* were observed. One is shown to the far right in the photograph. The staminate part of the spike has fallen. Below the broken tip of the stem is the normal pistillate part, while five inches below this and partially sheathed in the axils of the two uppermost leaves is an additional pistillate part. Such specimens with two superposed pistillate parts of the inflorescence have been found before in North America as is indicated by a specimen in the Gray Herbarium and one in the Herbarium of Yale University. The

Fig. 1. From the left, five plants of Typha angustifolia L. with juxtaposed pistillate spikes; at the right one Typha latifolia L. with superposed pistillate spikes.

former is without any statement of locality; it was collected by William Boott, July 25, 1869. The latter was found at New Haven, Connecticut, in 1858 by Prof. D. C. Eaton. Dr. G. F. Koch described[1] a somewhat similar condition in a plant with three superposed segments of the spike, the lowest being pistillate, the uppermost being staminate, while the median contained both staminate and pistillate flowers. Similar plants of *T. latifolia* were described and illustrated[2] by Dr. R. v. Soo. The other two abnormal specimens of *T. latifolia* observed along Alewife Brook also had two instead of one pistillate part of the spike, but on these plants the two pistillate parts were juxtaposed or twinned instead of being superposed. On their nearer faces each has a line which seems to represent a line of sterile tissue below and originally the line of cohesion of the two now separate parts. A single stem bears these two but as the fruits and their attendant bristles develop they exert a pressure upon each other causing the splitting of the stem both above and below. The upper part usually gives way utterly, thus reducing the tension on the lower part. In the Herbarium of the New England Botanical Club is just such a specimen as these, MASSACHUSETTS: bog on Day Farm, Scituate, Aug. 13, 1899, *Emile F. Williams*. Also, Mr. R. A. Ware writes me that he found a specimen of just this type in Provincetown, Massachusetts. American authors have occasionally recorded this sort of monstrosity, "The[3] same collector [name not given] has from Carlstadt, N. J., *Typha latifolia*, in which there are several small spikes arising side by side from the top of the culm, and which appear to be due to fission." In the same volume is another record,[4] "Mr. Bicknell displayed . . . specimens of *Typha latifolia*, L., showing fission of the spike." Half a dozen years later it was again recorded,[5] "David F. Day stated . . . that double fertile spikes are not uncommon in *T. latifolia*." This condition has likewise been recorded by European observers, as V. Borbás,[6] L. Ducamp,[7] and J.-B. Gèze.[8]

[1] Pollichia ix. 23 (1851).

[2] Typha És Hottonia Teratológiak. Archivum Balatonicum ii. 80 83, 2 figs. (1928).

[3] Bull. Torrey Bot. Club vii. 67 68 (1880).

[4] l. c. 93.

[5] Bull. Torrey Bot. Club xiii. 209 (1886).

[6] Orsz. középt. tanáregyesület Közlönye xiv. 286 (1881); and Oester. Bot. Zeitschr. xxxvi. 81 (1886).

[7] Ass. Fr. Av. Sc., Sess. Ajaccio ii. 533 (1901).

[8] Gèze, J.-B.: Études botaniques et agronomiques sur les Typha etc., U. de Paris, Thèses Série A, no. 680, 41 (1912).

As *T. angustifolia* is more abundant in the locality one would expect to find more than three, perhaps five abnormal plants in the area. On the contrary anyone walking along this stretch of meadowland by either bank of Alewife Brook, could not help being impressed with the abundance of freakish plants of *T. angustifolia*. Without any attempt to make an accurate complete census, Miss Bryant and the author walked along the high dry bank of both sides, peered into the fringe of Cat-tails and checked on a record book each abnormal specimen seen. The table that follows shows in a striking way their abundance.

Teratologic Plants of *Typha angustifolia* along ¼ mile of Alewife Brook.

Plants with 2 superposed pistillate parts of the spike	Plants with several juxtaposed pistillate parts of the spike	
1	Twinned	62
	Tripled	30
	Quadrupled	6
	Quintupled	2

Five of these plants are shown to the left in the accompanying illustration.

Plants of *T. angustifolia* with two superposed pistillate portions of the spike are also represented in the Herbarium of the New England Botanical Club and the Gray Herbarium, Massachusetts: filled land, Bay State Road, Boston, June 27, 1896, *Emile F. Williams*. Kansas: ponds, Reno County, Aug. 25, 1897, *A. S. Hitchcock*, no. 1,125. Switzerland: *N. C. Seringe*, no. 1,304. In the Herbarium of the Connecticut Agricultural Experiment Station at New Haven is a specimen from, Connecticut: near New Haven, June 16, 1876, *John A. Allen*. Likewise similar cases for this species have been recorded by Dr. A. Schnizlein[9] who figures it as well, and by J.-B. Gèze.[10]

The form with two or more juxtaposed portions of the spike was so very common at this locality[11] that the not unnatural expectation was to find abundant pressed specimens and many published notes. On the contrary the Gray Herbarium and

[9] Die Natürliche Pflanzen-familie der Typhaceen 9 (1845).

[10] Gèze, l. c. 39.

[11] On July 16, 1940, Messrs. Fernald & Long found an extensive colony of such *Typha angustifolia* (their nos. 12,223–12,228) on Cedar Island in Back Bay, Virginia, the 2–4 spikes variously cohering, entwining or splitting apart and becoming pendulous.

the Herbarium of the New England Botanical Club do not contain any such specimens of *T. angustifolia*, but the Academy of Natural Sciences of Philadelphia has the two following specimens: One with three juxtaposed pistillate spikes, from DELAWARE: ditches near Greenbank, June 7, 1880, *A. Commons;* and one with two juxtaposed pistillate spikes from DELAWARE: marshes, McCrones, Wilmington, Aug. 15, 1874, *A. Commons.* A prolonged search of American botanical publications did not reveal any published records of the sort. But, as before, several European botanists have detected and described the abnormality, see Beckhaus,[12] Wigand,[13] and J.-B. Gèze.[14] The latter in his monograph describes experiments and from these draws conclusions which answer the question that occurs to everyone, what is the cause of these queer forms, consequently a free translation from this portion of his treatise[15] is given here.

In July 1909 I removed from each living spike a few flowers in order to study them under the microscope. Sometimes with a scalpel I removed a minute fragment of the female axis in order to examine the protuberances.

Ten days afterwards, the holes in the surface of the spike, caused by these operations, had disappeared, but there remained in their places depressions; fifteen days later these depressions were dotted with numerous "anlagen." In the cases where the axis had been wounded, ten days afterward a longitudinal pad appeared extending from the injured point to the base of the spike. Finally these pads with a longitudinal portion of the axis separated from the principal spike, but remained attached to the stem immediately below. The place where the pad had arisen could be recognized by a white line formed of protruding hairs on the surface of the principal spike, which had newly regained its cylindrical shape. The detached portion also, thanks to the expansion of the cluster of hairs which surround each flower, had assumed a cylindrical form.

When the piece removed had been taken from the summit of the female spike, the two resulting spikes were equal in length, but the detached part, being less rigid, warped readily into a

[12] Jahresb. d. Westph. Ver. f. Wiss. u. Kunst, Muenster xiv. 122 (1886).
[13] Botanische Hefte ii. 98 (1887).
[14] l. c. 40–41.
[15] l. c. 41–43.

spiral.[16] I have thus been able to obtain several secondary spikes in juxtaposition to the principal one.

As I have said, it was in a pasture that I collected the *Typha* with three equal juxtaposed female spikes, the axis being cleft into 3 complementary parts which on being brought together reform a full cylindrical stem. Near the place where I collected this specimen the cows were in the habit of feeding. It is natural to suppose that one of them with one munch bit off the tip of the female spike and crushed the axis into three parts quite to its base.

Dr. Kronfeld[17] attributed this longitudinal partition of the female spike to alternations of dryness and humidity. He knew a station where he observed this in *T. angustifolia* each year. Dr. Kronfeld at first believed that he had found a proof of the origin of the multiple spikes of *Typha* and drew a parallel with the case of *Andropogon*, but a profounder study of more material convinced him, as my observations did me, that this splitting of the axis is due to wounding. The sudden variations in the quantity of water contained in the spike (this quantity can attain 3 to 5 times the weight of the dry spike) tear apart the tissues of the female axis, as Dr. Kronfeld verified by an anatomical study of the axis.

From studying the fresh Cat-tails no cause for their abnormal development was determined. These same specimens were left in a warm room for a week and then examined again. This time there were some very conspicuous light colored lines on the surface of the dark spikes, caused by the fluffing out of the bristles. That appearance gave a clue immediately, and in a few seconds by prodding with the point of a pencil a caterpillar was uncovered. At the end of each of the lines of light fluff, a similar caterpillar was found. They were about a centimeter in length, yellowish white, with narrow brown lines running longitudinally on the back. These larvae were found in every one of the ab-

[16] Mr. Gèze's phrasing of this is, "mais la partie détachée, moins rigide, se tordait bientôt en spirale." He so definitely says spirale that I translate it spiral, but in the case under discussion (as shown by his Plate II. fig. B.) which is the one that I saw most frequently, the several segments are attached to the common stem at the bottom, and, during the greater part of their development, at the top also. While held in this position the spikes are not free to warp in a spiral, but on the contrary only into an arc. This is of frequent occurrence, and, I believe, is what Mr. Gèze intended to describe.

[17] Kronfeld, Dr. E.-M.: Monographie der Gattung Typha, Sitzber. Akad. Wien. i. Abt. xvi. 105, 109 (1889).

normal spikes, sometimes one, sometimes many in a spike. With this knowledge it does not seem necessary to postulate the wounding of the young spike by a cow or by any other cause than the work of these parasitic larvae. They without question cause the splitting of the spike into two or more juxtaposed parts. Fresh material of the Cat-tails containing active larvae was furnished to Dr. C. T. Brues of Harvard University and to Mr. Anthony Spuler, Assistant Entomologist of the State College of Washington. Repeated attempts were made to raise the moths, until finally in June, 1921, Mr. Spuler succeeded. The moths were then submitted to the Smithsonian Institution and Mr. August Busck identified them as *Limnoecia phragmitella* Stainton. He writes that they are "cosmopolitan—found wherever *Typha* is found."

In a popular account[18] of the habits of this moth P. W. Claasen writes that the larvae spin a web to hold the cat-tail together, that they live over winter in it, and that the night-flying moths come in July.

The locality on Alewife Brook was under observation from 1917 to 1920. A similar locality in Europe is recorded by Dr. Kronfeld, and he states that the abnormal plants are produced year after year. In the former case it is certain that the large numbers of juxtaposed spikes are produced due to the activities of this larva; in the latter case the cause is probably the same.

One point as yet does not seem to be explained. The larvae of this moth cause the spikes of *Typha angustifolia* to have an abnormal development. *T. angustifolia*, however, has a distinctly limited range, and is far less common than *T. latifolia*. The moth in question is said to be "cosmopolitan—found whereever *Typha* is found." Along Alewife Brook the moths seemed to make an unerring selection, always choosing the spikes of *T. angustifolia* instead of those of *T. latifolia* when depositing its eggs. In other localities does this moth lay its eggs in *T. latifolia*? If so, are the Cat-tails that harbor them abnormal in development?

Osborn Botanical Laboratory,
Yale University,
New Haven, Conn.

[18] Claasen, P. W.: The tale of the cat-tail, Nat. Study Rev. xv. 244–262 (1919).

Lewis and Clark: Linguistic Pioneers.—Each year produces its own dreary procession of doctoral theses executed in the standard Teutonic tradition, and usually characterized by a titanic dullness. The subject[1] of the present review, although apparently a doctoral thesis of the conventional sort, is far from dull; much of its content consists of a fiction that is stranger than truth. This thesis deals with certain aspects of one of the more romantic and remarkable of the achievements of modern man in the New World—the great westward trek of the Lewis & Clark Expedition to the farthest parts of the North American continent during the years 1804–1806. The basic account of this exploration was written by the leader of the expedition, Captain Meriwether Lewis, during the course of the trip, and his intention was to have completed and corrected the journals on his return to the United States in 1806. But Captain Lewis died before he had opportunity to prepare the journals for publication, a fact to which doubtless may be ascribed many verbal inaccuracies that appeared in the original published edition of the Journal. These verbal inaccuracies have been carefully scrutinized by Dr. Criswell. The plan and purpose of this rather pretentious study, we are told, is to examine a list of some 1859 words selected from the Journals and arranged alphabetically, with a view to recording the peculiarities of the "American language" as it was written by the great explorers. Since neither Lewis nor Clark was particularly literate or equipped with much formal education, an extraordinary collection of colloquialisms, provincialisms, homely expressions, and plain misspellings, is the inevitable harvest. Typical are "dost of salts"; having "blankets fleed"; "ganarachah" and other "venerious" troubles; "ball-pated prairie"; "leagins and mockersons" [leggins and moccasins];—these and hundreds of others as good or better will serve to indicate how rich is the tilth and how bountiful the reward to the dutiful lexicographer. Had Associate Professor Criswell contented himself with the purely linguistic peculiarities of the Journals perhaps he would have done better, but instead he boldly ventures into the field of biology, obviously without adequate qualification. True, he arms himself with "acknowledgments" to several practitioners of botany and zoology, but these are poor talismans to ward off the evil spirits which persistently dog his intrepid footsteps through that part of the realm of natural science so vigorously portrayed in the Lewis & Clark Journals. When the author ventures into the botanical field, although following the blazes of Elliott Coues, Charles Vancouver Piper, and some other eminent students of flora and fauna, he loses the trees in the forest and gilds the lilies in the field. Many of his results and conclusions are nothing less than ludicrous, as, for example, placing mistletoe in the Aristolochiaceae, the custard apple in Menispermaceae, peppermint in the Cruciferae, stinking clover (*Cleome*) in the Sarraceniaceae, the genus *Brodiaea* in the Leguminosae, persimmon in the Sapotaceae, prickly pear and *Osmaronia* (which is called "fringe tree") in the Loasaceae, elderberry in the Valerianaceae, cucumber in the Campanulaceae, and the devil's-club (*Oplopanax horridum*) in the Compositae.

[1] Elijah Harry Criswell. Lewis & Clark: Linguistic Pioneers. University of Missouri Studies 15: i–ccxii, 1–102. 1940.

We are told that the plant with the rather fetching name of arsesmart is in the Liliaceae, but a few pages later it pops up in the genus *Polygonum*. Is this mutation, or merely experimental taxonomy? Most of the text consists of a commentary on and an interpretation of the Journals, but occasionally we are treated to a manifestation of sheer botanical inspiration, such as: "The May-apple is certainly so named because of the time at which its fruit matures . . ."! The author cannot be rightly said to be quite ruthless with personal names, in spite of Humboldt, Bonpland, and Ruth for our old friends HBK., or for referring to Mrs. Agnes Chase, the distinguished Washington agrostologist, as Miss Chase.

Obviously, our author is not a botanist; indeed, he lays no claim to being one; he is a student of words. Let us see what he does with some of the words. About half way through the book (p. clxiii) the following explanation is offered: "We now come to what is perhaps the most important lexicographical contribution of the present study—our list of over seven hundred terms . . . hitherto unrecorded in any dictionary. The Lewis & Clark Journals offer a rich treasure of new material which should be added to our dictionaries, but which has hitherto escaped all the lexicographers . . . Nearly six hundred of them have a claim to be considered as Americanisms." A few of these "Unrecorded Americanisms (Zoological and Botanical)" selected at random from Criswell's lists are: corvus, fucus, larus, Sagittaria sagittifolia, Canadian balsam, large fern, small fern, yellow lily, pennyroyal, long-leaved pine, narrow-leaved willow, alder, angelica, arrowhead, ash, bluebell, cedar, cherry, cinquefoil, coltsfoot, columbine, elder, fern, flax, garlic, gooseberry, grape, hazelnut, juniper, kale, lobelia, mulberry, nettle, onion, plantain, poplar, rape, raven, rose, rue, rye, service-berry, sorrel, spearmint, tansy, thistle, violet. All this, of course, is plain nonsense; these words obviously are not "Americanisms", either unrecorded or recorded; most of them are English names of plants that grow in England; several are biological names of genera of plants or animals. That the author has had at least a dim suspicion of this is indicated in the following rather lame explanation (p. clxix): "However, we do find several Latin borrowings in this list: *aborigines, corvus, larus, fucus,* and *Sagittaria sagittifolia.* The last four represent half-hearted attempts of the explorers to apply scientific terminology to some of the plants and animals, with the result that, unacquainted with scientific usage, they simply use the scientific term as a common name for the thing either singly or in combination with a qualifying adjective." What does he mean, "half-hearted"? Criswell argues (p. clxxiii) that when a name is "applied to a new genus there is an unquestionable extension in meaning, which, since to an American animal, is American by origin." Can it be possible that he believes that crows (*Corvus*), or gulls (*Larus*), were "new genera" discovered by Lewis & Clark? The argument that the word e. g., *elder,* when used by Lewis & Clark for plants of a western North American species not hitherto seen by human beings other than Indians, constitutes an "unquestionable extension in meaning", seems to be rather pointless in view of the fact that *elder* is a generic, *not* a specific term; it includes any or all individual plants of all existing species of

the genus *Sambucus*, all fossil species, as well as any species of elder yet to be evolved.

Many of the interpretations of botanical data listed under the heading of "Extensions of Meanings of New Genera" (p. clxxv) are entirely misleading, as, for instance, when Lewis is said to have used the word *beech* in a new sense for the common lowland alder (*Alnus rubra*) of the Pacific slope. Actually, this is what Lewis wrote: "The stem of the black alder arrives to a great size. It is simple, branching, and diffuse; the bark is smooth, of a light colour, with white spreading spots, *resembling those of the beech*." (italics mine). Clearly, Lewis was *not* using the term in a new generic sense; he was merely comparing the tree he was describing (alder) with another kind of tree (beech) with which he was familiar in eastern North America. The curious reader may supply himself with a considerable number of other instances of this sort. The author also gives tables of words supposed to have been used by Lewis & Clark long before they were used by anyone else, including such names as white oak, ironwood, white walnut, red cedar, arrowood, slippery elm, tamarack, etc. Actually, these names appeared in botanical works many years earlier. For example, some of them appear in the English edition of Peter Kalm's (1749–50) *Travels into North America* by J. R. Forster in 1770, while others were used by Michaux, Bigelow, Aiton, and other botanists some years before the publication of the Lewis & Clark Journal.

There is no need of citing additional examples from this plethora of scientific inaccuracies. It is obvious that the author has gone somewhat beyond his depth. It is a pity that the science of systematic botany has to bear the burden of such unripe scholarship. In conclusion, it can be pointed out that, although *Lewis & Clark: Linguistic Pioneers* may contain some material of value to lexicographers, it scarcely can be regarded as an authoritative source of botanical information, or even as a reliable commentary on the linguistic peculiarities of the Lewis & Clark Journals.—George Neville Jones, University of Illinois.

Napaea dioica in New England.—On August 24, 1940, while collecting along the "River Road", Lewiston, Vermont (Norwich railroad station), I found a clump of tall malvaceous plants growing beside an old cellar-hole three-fifths of a mile north of the Hanover bridge. A specimen was collected in the belief that it was an escape from cultivation, and by comparison with specimens in the Jesup Herbarium at Dartmouth College was identified as *Napaea dioica* L. The identification has been checked by Mr. C. A. Weatherby of the Gray Herbarium, from material subsequently sent to him. Further investigation at the original site disclosed two more clumps, in rather dry, sandy soil, one less than ten feet from the B. & M. railroad tracks, which lie in a cut just behind the cellar-hole. One clump con-

sisted only of long-petioled basal leaves, but the other two had about thirty flowering stems apiece, some five feet high with large diffuse panicles. The flowers were just coming into bloom when the plant was first seen, considerably later than the "July" of manuals. Only staminate plants have been collected.

According to the manuals, this plant is restricted to the limestone valleys of the Alleghenies, southwestern Pennsylvania to Virginia, and bottom lands in Ohio and Illinois to Minnesota. The species has been reported as an escape in the Arnold Arboretum[1]; it is apparently not otherwise known from New England. Gray's *Synoptical Flora of North America* (1895) says it is "rare, but . . . sometimes cultivated"; it is not, however, given in Bailey's *Manual of Cultivated Plants*, and it is doubtful if the plant has been widely cultivated in this region. Its appearance here might be ascribed to distribution by the railroad. The luxuriance of the growth indicates that the plant is well established and there seems no reason why it should not persist indefinitely.—John P. Brown, Dartmouth College, Hanover, New Hampshire.

Moss Flora of North America north of Mexico.—With the recent issue of Volume II, Part 4, Dr. A. J. Grout brings this monumental work to a successful conclusion. The three volumes, in four parts each, together with Dr. Grout's "Mosses with a Hand Lens and Microscope" make up a manual which should be sufficient for the American and Canadian Bryologist unless he is engaged in monographic or serious research work. The present section is by Dr. A. Le Roy Andrews and completes his treatment of the Bryaceae begun in Vol. II, Part 3. Besides this Dr. Andrews also covers the Mniaceae and the Rhizogoniaceae. The genera treated are Bryum, Rhodobryum, Mnium, Cinclidium and Rhizogonium. No section of the book will be more welcome to bryologists than this which brings together the confusing and cumbersome genus, Bryum, into a unified and apparently intelligible whole. Besides his editing of the entire work Dr. Grout has prepared artificial keys to Pohlia and Bryum based, as far as possible, on gametophyte characteristics. These keys are a very welcome addition to the more formal keys whose main distinctions are based on the sporophyte. Publication of this work was started in 1928 and every American bryologist owes Dr. Grout and his collaborators his thanks for the energetic manner in which it has been carried through to the end.—D. L. Ordway.

[1] E. J. Palmer, Journ. Arn. Arb. xi. 106 (1930).

Research Fellowship for Women.—A fellowship with $1,000.00 to $1,500.00 stipend is now being awarded by Sigma Delta Epsilon, Graduate Women's Scientific Fraternity. Applications and reference statements must be received before March 15, 1941, to be considered by the Board authorized to make the 1941–1942 award of this first Sigma Delta Epsilon Fellowship celebrating the twentieth anniversary of the founding of the organization.

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Application blanks may be secured from Dr. Nina E. Gray, University, Normal, Illinois. Announcement of the award will be made early in April.

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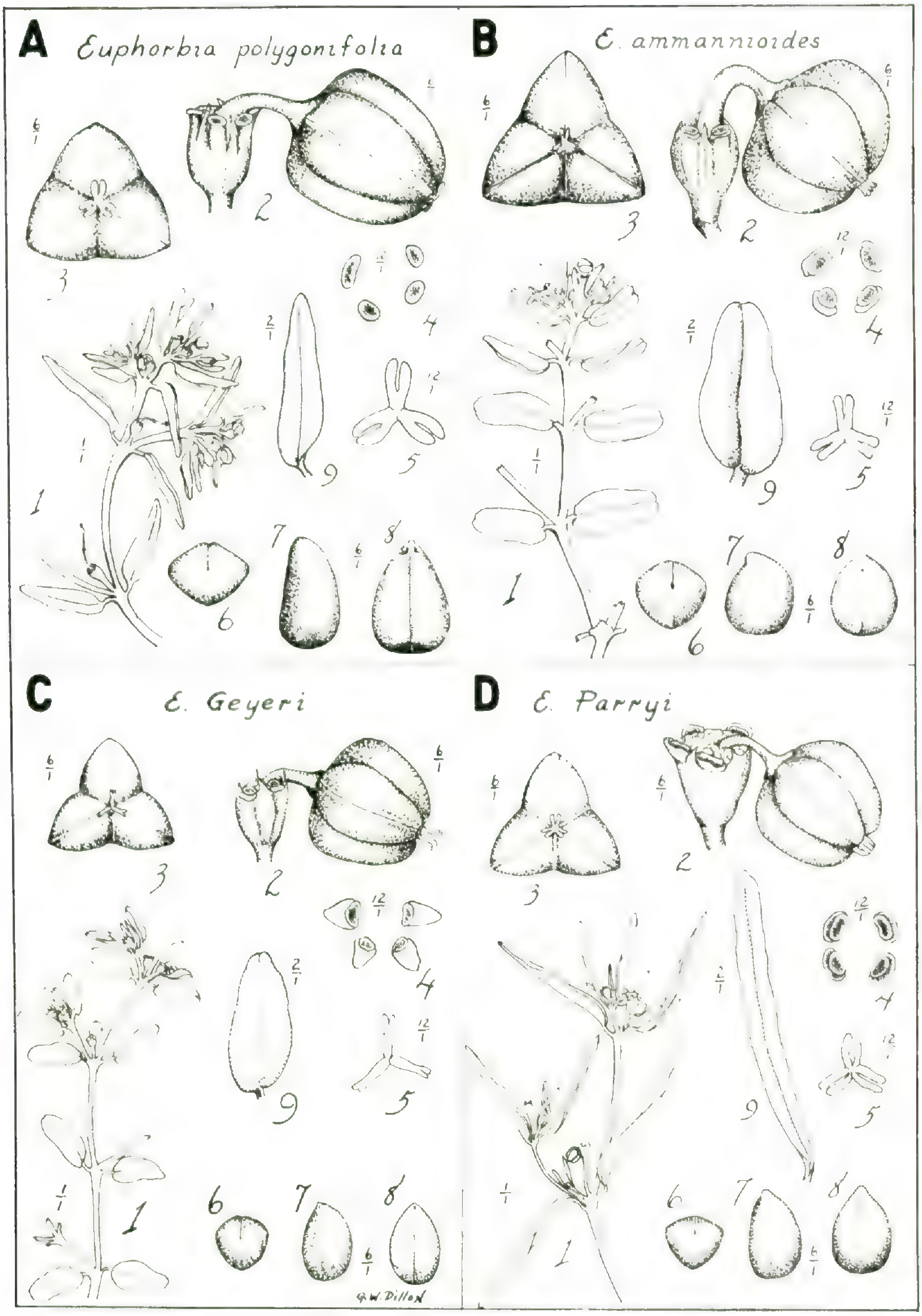

WHEELER ON EUPHORBIA

Rhodora

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CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. CXXXVI

EUPHORBIA SUBGENUS CHAMAESYCE IN CANADA AND THE UNITED STATES EXCLUSIVE OF SOUTHERN FLORIDA

Louis Cutter Wheeler

(Plates 654–668)

Introduction

From an early curiosity about the peculiar "flower" of *Euphorbia*, the writer's interest developed into a serious study of the genus, which soon led to the realization that not only was the structure of the "flower" involved but that the classification of the genus was in a remarkable state of confusion. Boissier in DC. Prod. **15 (2)**: 3–188. 1862, published the first revision of the entire genus since Linnaeus' time. Since 1862 the number of species of *Euphorbia* published has about doubled. Whereas Boissier recognized about seven hundred species as valid, Pax & Hoffmann in Engler & Prantl, Nat. Pflanzenfam. 2 Aufl., **19c.**: 209. 1931, *guess* that there are about one thousand six hundred species. With this great increase since an organized treatment of the genus the need of taxonomic revision is evident.

I. General Discussion

History

The following remarks apply only to the subgenus *Chamaesyce* except where expressly stated to be of broader scope. Wiman, in Linnaeus, Amoen. Acad. **3**: 102. 1756, lists *Chamaesyce* as a

synonym of *Euphorbia*. S. F. Gray, Nat. Arr. Brit. Pl. **2:** 260. 1821, in describing *Chamaesyce* as a genus, credits it to Dioscorides. Thus it is evident, if Gray's interpretation was correct, that the group was recognized in antiquity. Persoon, Syn. Pl. **2:** 12. 1806,[1] used *Chamaesyce* as a synonym of a defined but unnamed subdivision, of subgeneric rank, of *Euphorbia*. Rafinesque, Amer. Mo. Mag. **2:** 119. 1817, independently published *Chamaesyce* as a subgenus. Haworth, Syn. Pl. Succ., 159. 1812, proposed the genus *Anisophyllum* for the same entity but the name was preoccupied. Quite independently, Duby in A. P. DeCandolle, Botanicon Gallicum ed. 2, **1:** 412. 1828, took up the formerly unpublished *Euphorbia* section *Anisophyllum* of Roeper. Authors who have assumed that nomenclaturally this was based on *Anisophyllum* Haworth would do well to note this point. This sort of confusion of the independent use of the same name in either the same or different categories by different authors is common under *Euphorbia* and the genera segregated from it. This is due to the fact that many of these names are either traditional, as *Chamaesyce*, or suggested by some striking characteristic of the group, as *Anisophyllum*. For the more detailed history of the uses of the name applicable to this subgenus see beyond under the taxonomic section.

The workers who have made the principal contribution to our knowledge of *Euphorbia* subgenus *Chamaesyce* in the area under consideration are Boissier, George Engelmann, Millspaugh, and Small. Boissier revised the entire genus *Euphorbia* in 1862. Engelmann described many of the species discovered in the United States. Millspaugh's contribution was mainly new species, a multitude of new combinations, and the accumulation of invaluable fragments of types. His work is notable for the number of worthless new species that he proposed. Small either contributed the actual text for several of the principal floras of the region, or exerted a strong influence, as in the case of Rydberg's works.

My own publications relating wholly or partly to *Euphorbia* subgenus *Chamaesyce* are listed in the bibliography at the end of this section (pp. 106 and 107).

[1] As noted by Blake, Rhodora **17:** 134, footnote 1. 1915, pages 1–277 of "pars secunda" of Persoon's Synopsis Plantarum were published in 1806, as shown by the review of these pages in Botanische Zeitung, Regensburg **5:** 321. 1806 (Nov. 15).

Morphology

Roots: The lateral roots are ordinarily slender and branching in the manner common in small annual and perennial herbs. Occasionally the taproots become thickened and even subfarinaceous. Certain of the longer-lived perennials often develop buds well beneath the surface of the ground and the stems arise beneath the ground and come to the surface more or less scattered instead of originating from a common point at the surface.

Stems: The stems ordinarily have an interrupted main axis. After the first pair of primary leaves the main axis ceases to elongate. Lateral branches arise from the apex without any particular relation to the leaves. In species developing a single erect stem one branch only arises or, if more than one, then one soon dominates. If this stem attains any appreciable diameter the interruption of the main axis becomes completely concealed in the manner illustrated by Croizat in Degener, Fl. Hawaii, fam. 190, *Chamaesyce*$_{2-3}$. 1937. Whether this type of axial growth obtains in *Euphorbia gracillima* and *revoluta* is uncertain from herbarium specimens.

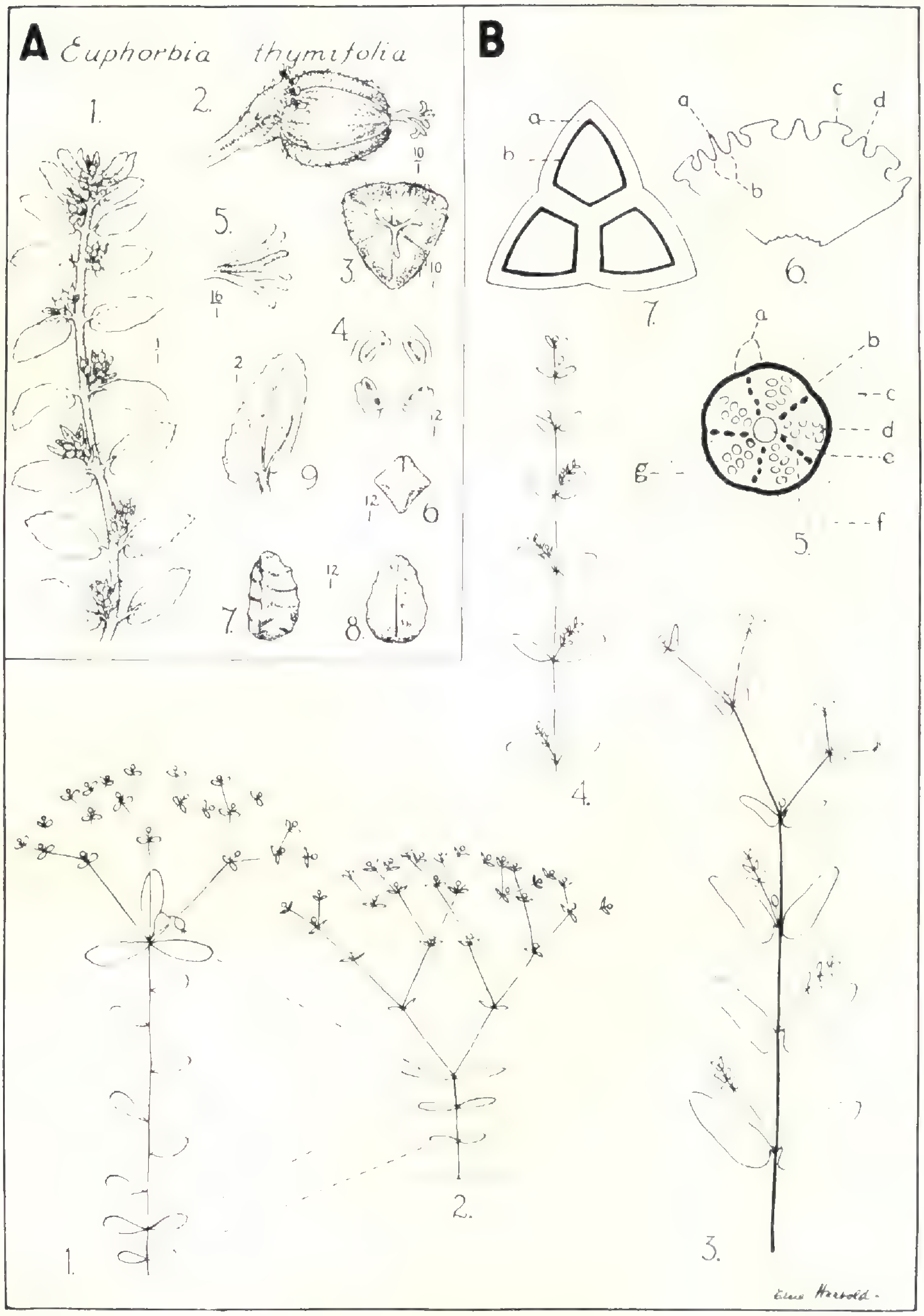
The origin of this type of branching was first suggested by Roeper, Enum. Euph., 30. 1824. He suggested that the branches arising from the crown of the main stem in subgenus *Chamaesyce* were homologous with the rays of the pleiochasium of *Euphorbia* subgenus *Esula* Pers. (*Euphorbia* sect. *Tithymalus*). This seems to be a very reasonable explanation. It is only necessary to add that, whereas the main axis in subg. *Esula* is terminated by a cyathium, in subg. *Chamaesyce* it is not. This would seem to be a fundamental difference but it is not. When by progressive reduction of the main axis subg. *Chamaesyce* finally arrived at the habit of branching after the first pair of true leaves appeared, the plant was obviously too small to produce all the elaborated food necessary for the production of a cyathium with its reproductive structures requiring abundant protein, fats, and carbohydrates; so we find that the cyathium which would otherwise terminate the main axis is omitted.

The often apparently lateral type of branching of the stems of subgenus *Chamaesyce* appears to differ from the plainly dichotomous or sometimes trichotomous type of the rays of subgenus *Esula*. But Roeper was equal to this difficulty. While poten-

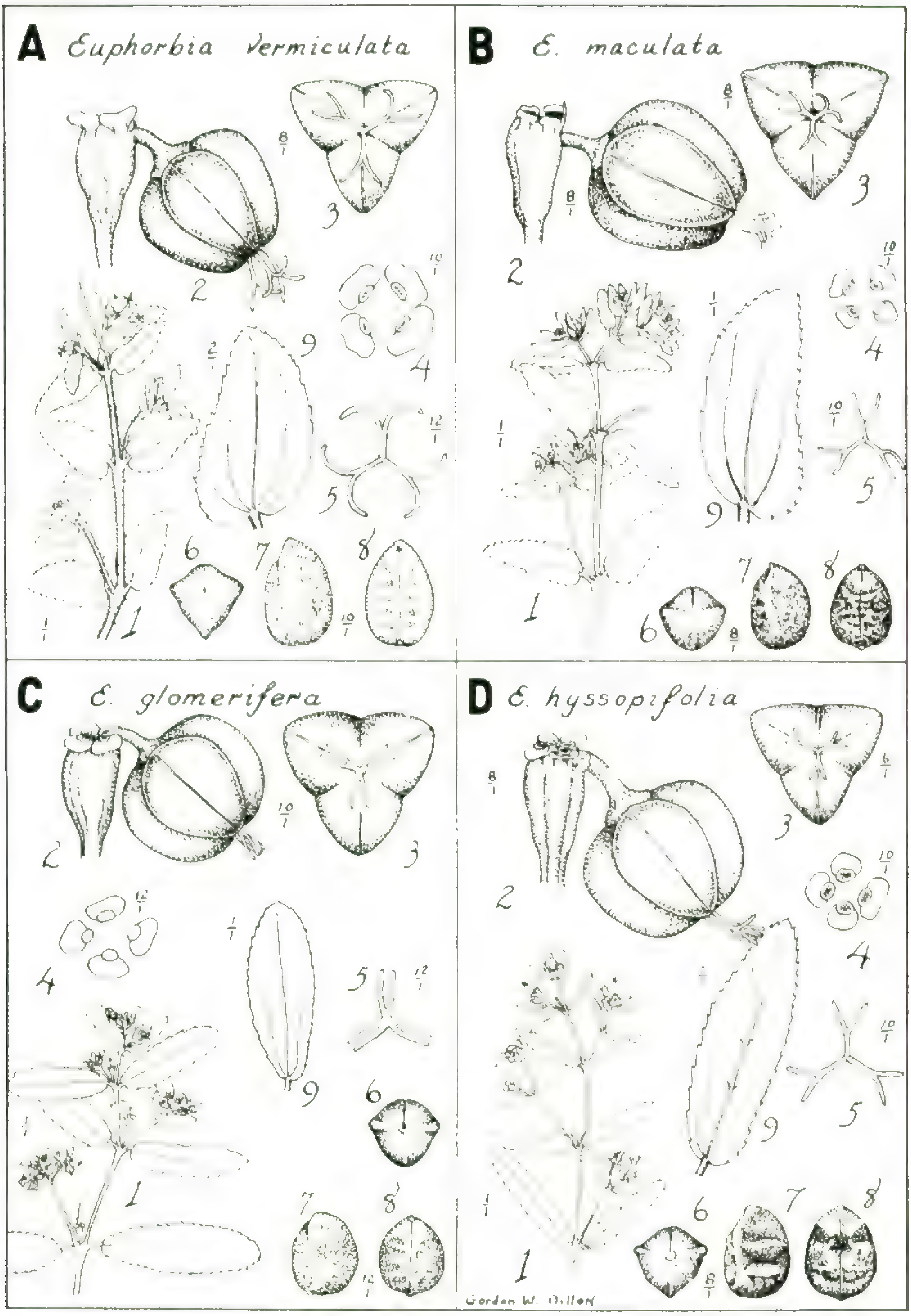
tially dichotomous, the branching in subg. *Chamaesyce* often, by reduction, becomes apparently ordinary lateral branching though it is really sympodial as shown by the position of the cyathia. But in species with this type of branching the stem-tips often exhibit symmetrical dichotomy with actually terminal cyathia. All the cyathia are morphologically terminal even though they appear axillary when the suppressed branch of the scorpioid sympodium is absent. Collateral branching, i. e., subsidiary branching in addition to the main and more or less suppressed branches of the dichotomy, is common.

Plate 655B, figs. 1–4, shows a possible reductional series from a member of either *Euphorbia* subg. *Esula* or *Agaloma*. Fig. 1 represents the ancestral type with stem-leaves alternate between the whorled leaves subtending the terminal pleiochasium and the first pair of true leaves. Both *E. Peplus* L. (subg. *Esula*), and *E. marginata* Pursh (subg. *Agaloma*) have this habit. The cotyledons are represented by the lowermost pair of lateral outgrowths of the stem. Fig. 2 shows the apparent type of axial growth of *E. gracillima* S. Wats. and *E. revoluta* Engelm. (subg. *Chamaesyce*). Whether this is actually the type of growth obtaining in these two species awaits confirmatory study of their seedlings. In any event, the type of axial growth shown in fig. 2 represents a plausible intermediate between fig. 1 and the type commonly found in subg. *Chamaesyce*. Fig. 3 is a diagrammatic representation of a branch of *E. maculata* L. showing the easy transition from a sympodium below to a subsymmetrical dichotomy at the apex. Fig. 4 shows a branch of the sort commonly found in members of subg. *Chamaesyce*, e. g. *E. supina* Raf. Here is shown the gradual suppression of alternate branches of the dichotomy until there is derived a scorpioid sympodium simulating an ordinary monopodium, In prostrate species such as *E. supina* the branches radiate from the sides of the short main axis. Whereas in fig. 2 the distance from the cotyledons to the first pair of true leaves is represented as about 1 cm., in more reduced species, as *E. supina*, it is of the order of a millimeter. Conclusion: The branches of members of subg. *Chamaesyce* are homologous with the pleiochasial rays of members of subgenera *Esula* and *Agaloma*.

Whether subgenera *Agaloma* and *Chamaesyce* are independent



Wheeler on Euphorbia



WHEELER ON EUPHORBIA

developments from subgenus *Esula*, or subg. *Esula* gave rise to subg. *Agaloma*, and that in turn to subg. *Chamaesyce*, or subg. *Agaloma* gave rise to two independent lines represented by subgenera *Esula* and *Chamaesyce*, is an obscure question which will occupy the attention of phylogenetic speculators for many unprofitable hours. Some members of *Euphorbia* subg. *Agaloma*, e. g. *E. marginata* Pursh and *E. corollata* L., have a pleiochasial inflorescence, and similar species, rather than any members of subg. *Esula*, may be the ancestors of subg. *Chamaesyce*, though the occurrence of subg. *Agaloma* only in the New World, as contrasted with the occurrence of subg. *Chamaesyce* on all continents, suggests that such ancestry is improbable.

Leaves: The leaves are simple, thin to thick. The margin is entire to variously toothed. The base is usually markedly inequilateral. The leaves, when sufficiently thin, exhibit a curiously mottled appearance when viewed by transmitted light. The venation is reticulate and the chlorophylliferous cells, instead of being distributed in the usual manner, are around the veinlets, thus leaving clear areas between. Veh, Ann. Jard. Buit. **38:** T. XV, figs. 32–34. 1928, illustrates this.

Stipules: The stipules are small, variously membranous, lacerate, connate, or distinct.

Vestiture: The trichomes, which constitute the only vestiture, are always simple. Most of them, unless very short, are multicellular, with the cells end to end. Occasionally, as in *Euphorbia hirta*, the distinction in size between hairs and capillary multiseriate segments disappears. Some of the divisions of the involucral lobes in *E. hirta* are no thicker than the trichomes on the lobes. The walls of the hairs are usually microscopically rugulose. In a few species such as *E. arizonica* and *setiloba* the cell-wall is quite smooth.

Cyathia: The cyathia are compound inflorescences simulating simple flowers yet consisting of few to numerous staminate flowers and a central pistillate flower, these surrounded by a cuplike involucre composed of commonly five foliar structures united by their margins. Alternating with the tips (lobes of the involucre) of these modified leaves are nectariferous glands. Each gland is supplied by two traces, one from each of the adjacent modified leaves. The glands often bear petaloid append-

ages. Usually one of the glands is missing and the pistillate pedicel is commonly deflexed into the interval thus created. Plate 655B, figs. 5 and 6, illustrate the structure of the cyathium and involucre.

The voluminous literature relating to the interpretation of the cyathium can be found by examining the bibliographies given by Pax 1884, Schmidt 1906, Denis 1921, Haber 1925, Bodmann 1937, and Schoute 1937.

The staminate flowers are pedicellate, naked and monandrous. Each staminate flower is primitively subtended by a bracteole. These bracteoles may be entirely free but are generally more or less connate and often adnate below to the involucre. The staminate pedicels are termed androphores in this paper.

The pistillate flowers are pedicellate and naked or with a rudimentary 3-lobed calyx. The pistillate pedicels are termed gynophores in this paper. The ovary is 3-locular and sessile. The styles are usually bifid. The structure of the dehiscent 3-locular capsule is illustrated in Plate 655B, fig. 7.

The embryo and endosperm are surrounded first by a light tan to nearly black structure here called the testa. Outside the testa is a layer of dried mucilage which is white and, depending on the thickness, makes the seed more or less white by obscuring the testa beneath. This dried mucilage is here called the coat. Pammel, 1891, has considered the structures surrounding the embryo and endosperm in the seeds of *Euphorbia.*

Relationships of Subgenus Chamaesyce

The subgenus *Chamaesyce* has probably, as suggested in the discussion above under stems, been derived from either subgenus *Esula* or *Agaloma.* It is with the greatest difficulty that, aside from the supposedly constant difference in the development of the main axis, subgenus *Chamaesyce* can be defined so as to exclude all members of those subgenera and at the same time include all members of subgenus *Chamaesyce.*

Geographical Distribution of the Subgenus Chamaesyce

Subgenus *Chamaesyce* occurs native in the warmer parts of all the continents including Australia. It reaches its greatest development in subtropical regions. It has attained a remarkable development in Hawaii where some species are arborescent.

An analysis of the geographical distribution of *Euphorbia* subgenus *Chamaesyce* in Canada and the United States exclusive of southern Florida has yielded the following data: Of the 48 species occurring in this area, 17 are originally endemic though 3 are now established in other parts of the world. Of the 17, 11 are found only west of the Mississippi River, 1 only east, and 5 on both sides. Of the 31 species not native solely within the specified area, 21 are native in this area plus Mexico. Few of these 21 range south of the northern half of Mexico. Of the 10 species not included in the two preceding categories, 3, viz. *E. glomerifera*, *hirta*, and *hyssopifolia*, are predominantly subtropical or tropical, and, within the area under consideration, are found native only in southern U. S. Most of the remainder are species with wide ranges in North and South America. While no introduced species has become established in the United States or Canada there have been local introductions of species native within the area. Notable examples are *E. maculata* and *supina*. On the other hand, some of the species native solely within the area have been introduced into Europe and elsewhere, e. g. *E. polygonifolia* and *supina*.

In order to determine what region had the largest number of species the distributional maps were examined to ascertain where a circle with a fifty-mile radius would include the largest number of species. Such a circle centering at Marsh, Pima County, Arizona, includes 25 species. Of this number probably only *E. supina* is introduced. This area is fairly well known botanically and it is not likely that there will be many additional species discovered in it. Curiously enough no species is endemic within the area circumscribed by this circle. A second center of density is Elephant Mountain, Brewster County, Texas. Within a fifty-mile radius of this point 21 species occur. Probably all of these are native. In view of the fact that this region is not well known botanically and that there are several more species in adjacent regions, it is highly probable that additional species will be found here. Two species and one very distinctive variety are endemic in this region.

It may be protested that both of these centers are merely points adjacent to the Mexican deserts and owe their density to a greater density southward. If an equal area is chosen any-

where in Sonora it is not likely to surpass the Arizonan center much if at all since several species which are common in Arizona are absent in Sonora. Similarly, several species have their southern limit included in the Big Bend area of Texas and the loss of these and the species endemic in the Big Bend area would scarcely be offset by species occurring in Chihuahua or Coahuila but not in Texas. Probably a third center of density is in southern Florida but determination of that must await examination of all the species found there.

Economic Value

The members of *Euphorbia* subgenus *Chamaesyce* are generally of little economic value. The species are often weedy but are rarely if ever classed as noxious weeds. Occasionally stock are supposed to be poisoned by accidentally eating some of these plants mixed with other herbage. Ordinarily not even grasshoppers will eat these plants. One Kansan correspondent informed me in 1938 that grasshoppers ate nearly everything except the spurges! Some use is made of *Euphorbia hirta* as a drug plant. Aboriginal peoples often utilize the latex in their medicine. There are persistent reports that these plants are remedies for snake bite. H. M. Hall, Yosemite Flora, 151. 1912, mentions that *E. serpyllifolia* is often used for this purpose by "Indians and others". C. R. Orcutt, 1890, also discusses the supposed virtues of these plants. No serious study of the allegedly theriacal qualities of the group seems ever to have been made.

It has been stated by Standley, Field Mus. Pub. Bot. **3:** 1930, and doubtless others, that *Euphorbia hirta* harbors the organisms causing tropical leg-ulcers. Dr. J. C. Bequaert of the Harvard Medical School assures me (in conversation) that there is no proof of this. Nevertheless I consider it entirely possible. Flagellates are common in many herbaceous species of *Euphorbia* and are by no means confined to even subtropical regions, for they have been found in Europe. No study seems to have been made of the species occurring in the United States, to determine whether they, too, harbor these organisms. The literature relating to flagellates in *Euphorbia* and other laticiferous plants is voluminous. Mesnil, Ann. Sci. Nat. ser. 10, Bot. **3:** xlii–lvii. 1921, gives an interesting resumé up to that date.

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II. Taxonomy

Scope of this Treatment

This paper is intended to include all native or naturalized species of the subgenus *Chamaesyce* occurring in Canada and the United States, exclusive of Southern Florida. The species occurring in the United States only in southern Florida are mostly closely related to, or even conspecific with, the West Indian species and can be satisfactorily treated only in relation to them. The line of demarcation in Florida is at about 26°–27° north latitude. This conclusion was drawn from examination of the abundant Floridan material of the subgenus at the New York Botanical Garden. After I had reached this conclusion, Mr. E. J. Alexander stated, in conversation, that 26° north latitude is the usual northern limit of subtropical species in Florida.

It is intended to treat all members of subgenus *Chamaesyce* growing in the area specified. For species occurring primarily within the area all synonyms or alleged synonyms have, so far as possible, been considered and referred to their proper position. In order that the exact basis of all conclusions may be evident, names are treated according to their types. All names based on one type are included in one paragraph. In this paragraph the type, its location, and whether it has been examined are all concisely indicated. An exclamation point (!) is used, as is customary, to indicate that the type, photograph of the type, or isotype has been examined.

Measurements

All measurements have been made on dried material with the exception of those of involucres, glands, androphores, bracteoles, and styles which were made after the parts were boiled in water. If in some cases it appears that the seeds would be a rather tight

fit for the capsules, remember that *fully* mature capsules dehisce on drying. Consequently the capsules measured on dry herbarium specimens are not only *slightly* immature but, in addition, must have shrunk a little in drying. This method of measuring, while open to some theoretical objections, is eminently practical since these plants are nearly always dry before identification is attempted.

The tangential dimension of the seed is the dimension in the plane normal to the radius when the seed is oriented as it is in the capsule. The radial dimension is comparable and is measured along the radius. A possible source of confusion is the statement as to the "radial" shape. This is the outline seen when looking along the radius and viewing the inner (raphal) face of the seed. The raphal face or the ventral side of the seed is the side toward the center of the capsule; the dorsal side is that away from the center.

Abbreviations

The herbaria from which material has been studied and from which specimens are cited in this revision are indicated by the following abbreviations:

A—United States Field Station, Sacaton, Arizona.
B—Berlin-Dahlem, Germany
C—University of California, Berkeley.
CA—California Academy of Sciences, San Francisco.
CL—University of California, Los Angeles.
Cl—Clokey Herbarium at Los Angeles Museum.
D—Dudley Herbarium, Stanford University, California.
Deam—private herbarium of C. C. Deam, Blufton, Indiana, now at or in process of transfer to Indiana University.
F—Field Museum, Chicago, Illinois.
G—Gray Herbarium, Harvard University, Cambridge, Mass.
Ge—Geneva, Switzerland.
I—Intermountain Herbarium, Utah State Agricultural College, Logan, Utah.
J—Herbarium of W. L. Jepson at University of California, Berkeley.
K—Royal Botanical Gardens, Kew, England.
Lam—Los Angeles Museum, Los Angeles, California.
M—Missouri Botanical Garden, St. Louis, Missouri.
Ma—Maria Mitchell Society, Nantucket, Mass.
Mi—University of Minnesota.
Mn—University of Michigan, Ann Arbor.
Mo—University of Missouri, Columbia.
N—National Arboretum, Washington, D. C.
NE—New England Botanical Club at Gray Herbarium.

NY—New York Botanical Garden, New York City.
O—Oberlin College, Oberlin, Ohio.
P—Pomona College, Claremont, California.
Peir—Herbarium of Frank W. Peirson, 1077 New York Ave., Altadena, California.
Ph—Academy Natural Sciences, Philadelphia.
PhB—Philadelphia Botanical Club at Acad. Nat. Sci., Philadelphia.
RS—Rancho Santa Ana Botanic Garden, Anaheim, California.
SB—Santa Barbara Museum, California.
Sh—Forrest Shreve, private herbarium, Tucson, Arizona.
T—University of Arizona, Tucson.
US—United States National Herbarium, Washington, D. C.
W—Herbarium of the author.

Since completing the manuscript, the herbarium of Catholic University of America, Washington, D. C., and specimens from Southern Branch, University of Idaho, Pocatello, have been examined and important extensions of ranges incorporated in the maps, but no specimens from these herbaria are cited.

Key to Subgenera of Euphorbia Occurring in Canada and the United States

In order that it may be ascertained whether the *Euphorbia* in hand is to be found in this paper the following key to the subgenera in this area is offered.

1. Glands of the involucre without petaloid appendages; glands deeply cupped if leaves opposite below the inflorescence; leaves essentially symmetrical.
   2. Glands of the involucre either deeply cupped or concealed by the inflexed linear segments of the margin; stem never branching into a symmetrical 3–several-rayed inflorescence . . . . I. *Poinsettia*.
   2. Glands of the involucre flat or convex, never concealed; leaves nearly always alternate below (stem-leaves), in a single whorl beneath the pleiochasium which is a cyme resembling an umbel (whorled leaves), opposite in the symmetrically forking inflorescence (floral leaves) . . . . II. *Esula*.
1. Glands of the involucre with petaloid appendages or, if appendages wanting, leaves all strictly opposite and with inequilateral bases.
   3. Leaves alternate, opposite, or even whorled, their bases symmetrical; stipules glandlike or none . . . . III. *Agaloma*.
   3. Leaves all strictly opposite, their bases usually strongly inequilateral; stipules mostly well developed, always evident in species with symmetrical leaves . . . . IV. *Chamaesyce*.

I. Subg. Poinsettia (Graham) House, N. Y. State Mus. Bull. **254:** 473. 1924. (*Poinsettia* Graham, New Philos. Journ. **20:** 412. 1836). For additional synonymy see Contr. Gray Herb. **127:** 58–59. 1939.

II. Subg. Esula Pers., Syn. Pl. **2:** 14. 1806. (*Euphorbia* sect. *Tithymalus* of various authors. *Tithymalus* Adans., Fam. Pl. **2:** 356, 611. 1763, et al. *Galarhoeus* Haw., Syn. Pl. Succ., 143. 1812.)

III. Subg. Agaloma (Raf.) House, N. Y. State Mus. Bull. **254:** 471. 1924. (*Agaloma* Raf., Fl. Tellur. **4:** 116. 1838; *Lepadena* Raf., op. cit., 113; *Dichrophyllum* Klotzsch & Garcke, Monatsb. Akad. Berlin **1859:** 249. 1859; *Tithymalopsis* Klotzsch & Garcke, l. c.; *Zygophyllidium* (Boiss.) Small, Fl. SE U. S. 715. 1334. 1903). For additional synonymy see Contr. Gray Herb. **127:** 57–58. 1939.

IV. Subg. Chamaesyce Raf., Amer. Mo. Mag. **2:** 119. 1817. Type: *Euphorbia supina* Raf.—*Chamaesyce* Raf. l. c., *nomen provisorium* under the above name. Both proposed without reference to Persoon.

Chamaesyce, Pers., Syn. Pl. **2:** 12. 1807 (as synonym of a defined subdivision of *Euphorbia* of subgeneric rank). Type: *Euphorbia Chamaesyce* L.

Anisophyllum Haw., Syn. Pl. Succ., 159. 1812, not Jacquin, Select. Stirp. Amer. Hist., 283, T. CLXXX, fig. 5. 1763. Type: *A. Peplis* (L.) Haw.; based on *Euphorbia Peplis* L. Klotzsch, Monatsb. Akad. Berlin **1859:** 247. 1859; Klotzsch, Abh. Akad. Berlin, Phys. **1859:** 13, 21. 1860.—Schweinfurth, Beitrag Fl. Aethiop. **1:** 34. 1867.—*Euphorbia* section *Anisophyllum* (Haw.) Pax in Engler & Prantl, Nat. Pflanzenfam. **3** (**5**): 104. 1891; Pax & Hoffman, Nat. Pflanzenfam. 2 Aufl. **19c:** 210. 1931.—*Euphorbia* subgenus *Anisophyllum* (Haw.) Heinrich Ludwig Schmidt, Über die Entwicklung der Blütenstände von *Euphorbia* L. und *Diplocyathium* n. g., 16. 1906, preprint from Beih. Bot. Centralblatt **22:** 32. 1907, published merely as "Untergattung Anisophyllum Haw." Without basinym, hence not valid.

Chamaesyce S. F. Gray, Nat. Arr. Brit. Pl. **2:** 260. 1821. Type: *Chamaesyce maritima* S. F. Gray, an actually and avowedly superfluous name for *Euphorbia Peplis* L. Small, Fl. SE U. S., 707. 1903; Millsp., Field Mus. Pub. Bot. **2:** 300. 1909; Lunell, Amer. Midl. Nat. **1:** 204. 1910; Small in Britton & Brown, Ill. Fl. No. U. S. & Canada, ed. 2, **2:** 462. 1913; Millsp., Field Mus. Pub. Bot. **2:** 384. 1914; Millsp., op. cit., 401. 1916; Britton, Fl. Bermuda, 212. 1918. Britton & Millsp., Bahama Fl., 237. 1920; Prokhanov, Consp. Syst. Tith. Asiae Mediae, 14. 1933; Hara, Journ. Jap. Bot. **11:** 511. 1935; Degener & Croizat in Degener, Fl. Hawaii, fam. 190, Chamaesyce. 1936 & 7.—*Euphorbia* subgenus *Chamaesyce* (S. F. Gray) House, Bull. N. Y. State Mus. **254:** 470. 1924.

Euphorbia section *Anisophyllum* Roeper in Duby, A. P. De Candolle, Bot. Gall. ed. 2, **1:** 412. 1828. Type: *Euphorbia*

Peplis L., designated here. G. D. J. Koch, Syn. Fl. Germ. Helv., 627. 1837; Ledebour, Fl. Ross. **3** (**2**): 557. 1849–51; Baillon, Étude Gen. Euphorb., 284. 1858; Engelmann in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 185. 1859; Boissier in DC. Prod. **15** (**2**). 1862; Muell. Arg. in Martius, Fl. Brasil. **11** (**2**): 669. 1874; Bentham & Hooker, Gen. Pl. **3**: 258. 1883; Chiovenda, Bull. Soc. Bot. Ital. **1895**: 61. 1895; Thellung, Bull. Herb. Boiss. sér. 2, **7**: 746. 1907; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7**: 422. 1917; Denis, Euphorb. Iles Austr. Afr., 27. 1921.—*Tithymalus* [Tourn.] section *Anisophyllon* Gomez de la Maza, Fl. Habanera, 152. 1897.

Euphorbia A. *Chamaesyce* Reichenbach, Fl. Germ. Excurs., 755. 1832.[1] Type: *Euphorbia Chamaesyce* L. Reichenbach, Repert. Herb. Nom., 193. 1841, as *Euphorbia* "1. Chamaesyce *Caesalp.*"; Nyman, Consp. Fl. Eur. **3**: 655. 1881, merely as *Euphorbia* "g. Chamaesyce Rchb."

Xamesike Raf., Fl. Tellur. **4**: 115. 1838. Type: *X. vulgaris* Raf.; based on *Euphorbia Chamaesyce* L. Rafinesque, Aut. Bot., 96. 1840.—*Xamesike* subgenus *Xamesike* Raf., op. cit., 97.

Xamesike subgenus *Xamobala* Raf., Fl. Tellur. **4**: 115. 1838; Type: *Xamesike supina* (Raf.) Raf., based on *Euphorbia supina* Raf.; Rafinesque, Aut. Bot., 97. 1840.

Aplarina Raf., New Fl. No. Amer. **4**: 98. 1838. Type: *A. prostrata* Raf. proposed without reference to *Euphorbia prostrata* Aiton.—*Xamesike* subgenus *Aplarina* (Raf.) Raf., Aut. Bot., 97. 1840.

Euphorbia section *Anisophyllum* § *Acutae* Boiss. in DC. Prod. **15** (**2**): 18. 1862. Type: *Euphorbia acuta* Engelm. Pax in Engler & Prantl, Nat. Pflanzenfam. **3** (**5**): 104. 1891; Pax & Hoffmann in Engler & Prantl, Nat. Pflanzenfam. 2 Aufl. **19c**: 210. 1931.

Euphorbia section *Anisophyllum* § *Chamaesyceae* Boiss. in DC. Prod. **15** (**2**): 27. 1862. Type: *Euphorbia Chamaesyce* L. Proposed without reference to earlier uses of similar names though Boiss., op. cit., 11, cites in synonymy under sect. *Anisophyllum*, genus *Chamaesyce* Haw., and "Sect. Chamaesyce *Reichb. Fl. Germ. exc. p.* 755."

Euphorbia section *Anisophyllum* § *Hypericifoliae* Boiss. in DC. Prod. **15** (**2**): 20. 1862. Type: *Euphorbia hypericifolia* L. Pax in Engler & Prantl, Nat. Pflanzenfam. **3** (**5**): 104. 1891; Pax & Hoffmann, in Engler & Prantl, Nat. Pflanzenfam. 2 Aufl. **19c**: 210. 1931.

Euphorbia subgenus *Anisophyllum* Gaucher, Étude anat. genre Euphorbia, 123. 1898; proposed independently and described, no species assigned.

Glabrous to vestite herbs or sometimes sub-shrubs; leaves

[1] See page preceding title page between 434 & 435 for dates.

opposite, simple, mostly with inaequilateral bases, petioles short to none; stipules small, often united; cyathia solitary at the nodes and bifurcations or more or less congested into cymes; glands mostly 4, appendiculate or exappendiculate; staminate flowers few to numerous; bracteoles few to numerous, free to variously connate and adnate; ovary 3-celled; styles 3, bifid to entire, mostly free; capsules small, dehiscent; seeds small, ecarunculate, smooth to variously sculptured, with a gelatinous coat of varying thickness.—This description applies only to the species included in this paper.

Key to the Species of Subgenus Chamaesyce

1. Ovary and capsule vestite.
  2. Perennial (except no. 3b with capsule ca. 2.5 mm. in diam.); staminate flowers 16–60 or rarely as few as 15 in nos. 25 and 26; involucres never urceolate.
    3. Cyathia borne in dense cymose glomerules, or a few in addition sometimes solitary in the upper bifurcations; leaves often serrate . . . . 17. *E. capitellata.*
    3. Cyathia solitary at the nodes and at the tips of the branches; leaves always entire.
      4. Seeds scarcely angled, narrowly ovoid, encircled by 4–5 rounded ridges . . . . 22. *E. pediculifera.*
      4. Seeds quadrangular, variously smooth to slightly wrinkled.
        5. Herbage with short, straight spreading hairs.
          6. Capsules 1.1–1.3 mm. in diam.; seeds sharply quadrangular . . . . 26b. *E. polycarpa* var. *hirtella.*
          6. Capsules ca. 2.5 mm. in diam.; seeds ovoid to ovoid-quadrangular . . . . 3b. *E. ocellata* var. *Rattanii.*
        5. Herbage variously clothed with appressed, long and weak, or matted hairs.
          7. Leaves acuminate, median mostly over 1 cm. long.
            8. Stems strigose; seeds 1.6–1.9 mm. long; capsules 2.1–2.4 mm. long . . . . 19. *E. angusta.*
            8. At least the young stems villous; seeds 2.2–2.5 mm. long; capsule ca. 3 mm. long . . . . 18. *E. acuta.*
          7. Leaves mostly blunt, never more than sub-acute, rarely as much as 1 cm. long.
            9. Capsules ca. 2.5 mm. long; seeds ca. 2 mm. long . . . . 20. *E. lata.*
            9. Capsules not over 2 mm. long; seeds not over 1.7 mm. long.
              10. Appendages wider than the glands and with short spreading hairs beneath and on the margins . . . . 24. *E. vallis-mortae.*
              10. Appendages wide to absent, glabrous or rarely with a few hairs beneath next to the involucre.
                11. Appendages usually conspicuous; styles not clavate; involucres open-campanulate . . . . 25. *E. melanadenia.*
                11. Appendages absent or very narrow; styles clavate; involucres turbinate. 23. *E. cinerascens.*

2. Annual (except no. 39 with urceolate involucre); staminate flowers up to 12, or sometimes to 15 in nos. 35b and 43; capsules less than 2 mm. in diam.
  12. Involucre urceolate.
    13. Appendages entire or crenate; hairs mostly clavate; perennial .... 39. *E. arizonica.*
    13. Appendages deeply parted into a few attenuate segments; hairs tapering; annual .... 40. *E. setiloba.*
  12. Involucres obconical to campanulate.
    14. Cyathia borne in dense axillary and terminal leafless glomerules .... 16. *E. hirta.*
    14. Cyathia solitary or on short leafy lateral branchlets.
      15. Proximal appendages greatly prolonged, often concealing the capsule .... 43. *E. indivisa.*
      15. Proximal and distal appendages without marked disparity in size.
        16. Seeds punctately pitted and mottled, base depressed-truncate, apex sharply acute; styles entire, sometimes emarginate .... 47. *E. stictospora.*
        16. Seeds neither punctately pitted nor mottled, base obtuse, apex not sharply acute; styles bifid.
          17. Glands without appendages or with but the merest rudiment; seeds smooth; leaves entire, not over 8 mm. long; vestiture short, straight, and spreading .... 28. *E. micromera.*
          17. Glands appendiculate; seeds variously ridged or granular; leaves often serrulate, some often over 8 mm. long; vestiture long and weak, crisped, or appressed.
            18. Capsule sparsely villous; seeds not transversely ridged .... 35b. *E. serpyllifolia* var. *hirtula.*
            18. Capsule strigose, or if with spreading hairs, seeds with transverse ridges.
              19. Seeds with low rounded transverse ridges not whitened on the summit or with merely granular surfaces; capsules strigose.
                20. Styles ca. 0.4–0.5, rarely to 0.6, mm. long, clavate; seed coat not granular; nodes never rooting.
                  21. Capsules all exserted from the involucre .... 45. *E. supina.*
                  21. Capsules mostly half included and distending the involucre at maturity .... 44. *E. thymifolia.*
                20. Styles ca. 0.7 mm. long, slender; seed coat granular; nodes often rooting 46. *E. humistrata.*
              19. Seeds with narrow sharp transverse ridges, or rounded transverse ridges whitened on the summit; capsules tomentose or with crisped spreading hairs.
                22. Herbage grayish-pilose-tomentose; seeds 1.1–1.3 mm. long, the rounded ridges about the same width as the intervals between .... 49. *E. laredana.*
                22. Herbage green or greenish, less densely vestite to sub-glabrous; seeds 0.9–1

mm. long, the minute sharp ridges narrower than the intervals between
48. *E. Chamaesyce.*

1. Ovary and capsule glabrous.
 23. Stipules united into a white, glabrous, membranous scale.
  24. Annual; staminate flowers 5–10 .... 30. *E. serpens.*
  24. Perennial; staminate flowers 12 or more .... 31. *E. albomarginata.*
 23. Stipules not united into a white, glabrous membranous scale.
  25. Styles entire, either very short and capitate or as long as the capsule and very slender.
   26. Styles about as long as the capsule, slender; leaves sharply serrulate; annual .... 34. *E. Hooveri.*
   26. Styles very short, capitate; leaves entire; perennial. . . 33. *E. astyla.*
  25. Styles bifid or if entire neither extremely short and capitate nor about as long as the capsule.
   27. Face of seed virtually flat, the inflexed apical mucro overhanging the raphe .... 2. *E. platysperma.*
   27. Face of seed not flat; apical mucro wanting or minute and by no means overhanging the raphe.
    28. Delicate erect annuals with symmetrical linear leaves and capsules 1.3–1.4 mm. long.
     29. Seeds transversely wrinkled or ridged; involucre 0.9–1 mm. in diam.; appendages no longer than the glands; ultimate branchlets 0.15–0.25 mm. in diam.; longest leaves rarely as short as 1 cm. .... 9. *E. revoluta.*
     29. Seeds smooth; involucre 0.5–0.7 mm. in diam.; appendages usually longer than the glands; ultimate branchlets ca. 0.1 mm. in diam.; longest leaves mostly shorter than 1 cm. . . 8. *E. gracillima.*
    28. Annuals or perennials, if leaves linear and symmetrical plants coarse and/or capsules more than 1.8 mm. long.
     30. Capsules 3–3.5 mm. long.
      31. Seeds sharply angled, larger leaves 2 cm. or more long .... 11. *E. trachysperma.*
      31. Seeds compressed-ovoid; leaves not over 16 mm. long .... 1. *E. polygonifolia.*
     30. Capsules less than 3 mm. long.
      32. Erect annual; leaves linear, symmetrical, with sharp discrete serrulations; capsule ca. 2.5 mm. long; appendages conspicuous; seed subalately angled .... 10. *E. florida.*
      32. Perennial, or if erect and annual, leaves not as above, and seeds not subalately angled.
       33. Glands exappendiculate or with but a minute rudiment; leaves always entire, never linear, never more than 10 mm. long.
        34. Seeds with transverse ridges .... 38. *E. theriaca.*
        34. Seeds smooth to rugulose but never transversely ridged.
         35. Capsule 2–2.3 mm. long; seeds 1.1–1.4 mm. in diam. .... 3. *E. ocellata.*
         35. Capsule not over 1.8 mm. long; seeds not over 0.8 mm. in greatest diam.
          36. Annual; staminate flowers 2–5. . 28. *E. micromera.*
          36. Perennial; staminate flowers 15–50.

37. Glands discoid; staminate flowers 40–50 . . . . 27. *E. Parishii.*
37. Glands transversely oblong; staminate flowers 15–32 . . . . 26. *E. polycarpa.*
33. Glands with appendages; leaves sometimes serrate, sometimes more than 10 mm. long.
38. Robust erect annuals with the larger leaves mostly over 15 mm. long, margins serrate.
39. Capsule 1.6–2.3 mm. long, wider below the equator, cymes not very dense and of mostly few to several cyathia.
40. Stems usually crisply hairy at least on the young tips, rarely pilose; seeds finely wrinkled . . . . 13. *E. maculata.*
40. Stems mostly glabrous, sometimes pilose; seeds with broad very shallow depressions separated by low smooth ridges . . . . 12. *E. hyssopifolia.*
39. Capsule 1.3–1.4 mm. long, widest at the equator or nearly so; cymes mostly very dense with numerous cyathia . . . . 15. *E. glomerifera.*
38. Small prostrate to erect annuals or perennials with largest leaves mostly less than 15 mm. long, if robust and erect, leaves all entire, herbage completely glabrous, and seeds smooth.
41. Cyathia in leafless terminal cymes, a few in addition sometimes in the upper bifurcations; stems not pilose 17. *E. capitellata.*
41. Cyathia solitary, or if in leafy cymes, stems pilose.
42. Seeds with definite transverse ridges.
43. Seeds radially oblong-ovate to oblong; capsule widest at the equator; at least the stems often vestite . . . . 37. *E. Abramsiana.*
43. Seeds ovate radially; capsule widest well below the equator; herbage always glabrous . . . . 36. *E. glyptosperma.*
42. Seeds smooth to rugulose but never with regular transverse ridges.
44. Herbage variously vestite.
45. Seeds smooth and mostly chalky white, sharply angled; leaves sharply serrulate; annual . . . . 42. *E. serrula.*
45. If seeds smooth and white leaves entire and plant perennial.
46. Leaves entire; perennial; herbage pubescent . . . . 26. *E. polycarpa.*
46. Leaves not entire, or if entire and plant perennial, stem pilose.
47. Carpels mostly prolonged into an empty carina; stems white with long tapering hairs . . . . 41. *E. villifera.*

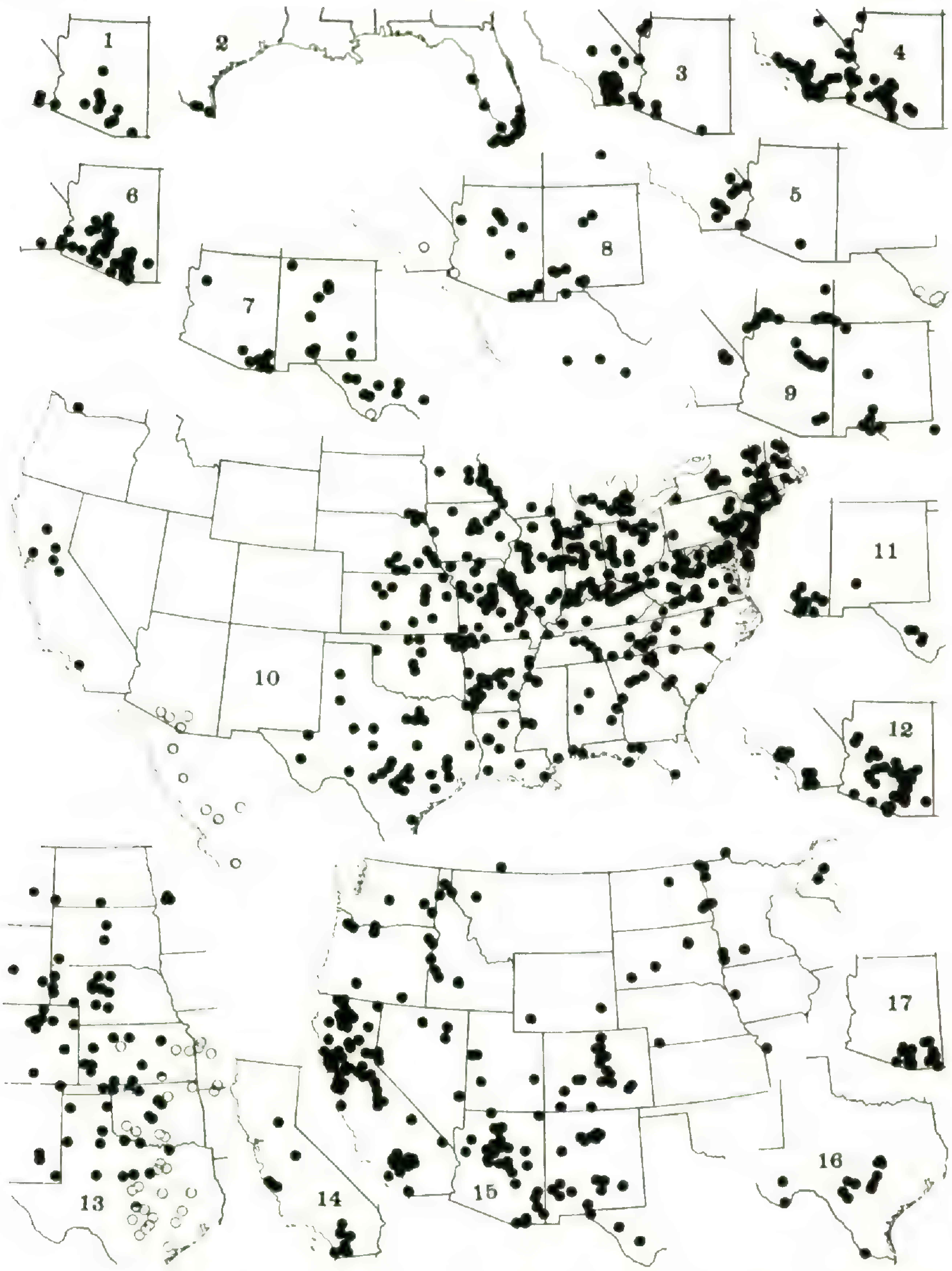
47. Carpels never prolonged; stems never white with long tapering hairs.
48. Leaves 5–15 or rarely 19 mm. long, ovate to lanceolate . . . . 14. *E. vermiculata.*
48. Leaves 3–7 mm. long, broadly oblong to oblong-cuneate
35b. *E. serpyllifolia* var. *hirtula.*
44. Herbage glabrous except stipules sometimes with cilia.
49. Seeds smooth, plump; leaves always entire; plants annual, mostly drying yellowish green.
50. Appendages narrow and ascending; involucre cupuliform-campanulate . . . . 4. *E. Parryi.*
50. Appendages narrow to wide but spreading; involucre obconical to campanulate.
51. Staminate flowers 5–20; plants mostly prostrate.
52. Styles slender, not thickened at the tip; involucres 1–1.1 mm. in diam.; androphores 1–1.3 mm. long; seeds 1.3–1.6 mm. long; leaf-blades 4–10 mm. long; appendages mostly 1–3 times as wide as gland . . . . 6. *E. Geyeri.*
52. Styles thickened at the tip or rarely thicker below and somewhat tapering; involucres 1.2 –1.6 mm. in diam.; androphores 1.4–2 mm. long; seeds 1.5–1.9 mm. long; leaf-blades 4–15 mm. long; appendages mostly narrower than the gland . . . . . . 5. *E. ammannioides.*
51. Staminate flowers more than 20; plants ascending to erect . . . . 7. *E. missurica.*
49. Seeds often wrinkled, if smooth mostly slender; leaves sometimes serrulate; plants annual or perennial mostly drying brownish to green.
54. Epidermis papillate at least on the nodes; carpels often prolonged into an empty carina . . . . 41b. *E. villifera* var. *nuda.*
54. Epidermis not papillate; carpels not prolonged.

55. Stipules parted into numerous filiform segments; leaves entire and mostly with cordate bases. . . . 29. *E. cordifolia.*
55. Stipules not as above; leaves serrulate or entire, not cordate-based.
56. Capsules more than 2 mm. long . . . . 32. *E. Fendleri.*
56. Capsules less than 2 mm. long.
57. Annual with entire leaves; seeds 1.6–1.8 mm. long . . . . . . 21. *E. Golondrina.*
57. Perennial, or leaves mostly serrulate if annual; seeds 1–1.4 mm. long.
58. Perennial; leaves entire; stipules ciliate (except in var. *simulans*); stems never winged . . . . . 26. *E. polycarpa.*
58. Annual; leaves mostly serrulate; stipules glabrous; stems often winged 35. *E. serpyllifolia.*

1. Euphorbia polygonifolia L., Sp. Pl. **1:** 455. 1753. Type: "*Habitat in* Canada, Virginia", *Kalm* (Linnaean Herbarium, not seen; photograph G!). Boissier in DC. Prod. **15** (**2**)**:** 28. 1862; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 439. 1917. *Anisophyllum polygonifolium* (L.) Haw., Syn. Pl. Succ., 160. 1812. *Xamesike polygonifolia* Raf., Aut. Bot., 98. 1840; based on "Euph. O[mnes]", i. e. doubtless *E. polygonifolia* of everybody, hence, by inference, Linnaeus.—*Chamaesyce polygonifolia* (L.) Small, Fl. Se. U. S., 708, 1333. 1903.

E. maritima Nutt., Trans. Amer. Philos. Soc. **5:** 171. 1837. Type: "Sea coast, L[ittle?] Egg Harbor", New Jersey, [*Nuttall*?] (Ph!, possibly only isotype; photographs G!, W!).

Glabrous annual; stems few to several, mostly prostrate, sometimes ascending to erect, 1–25 cm. long, 1–2 mm. in diam., internodes 0.5–5 cm. long; leaf-blades 6–16 mm. long, oblong-linear to oblong-lanceolate, midrib prominent beneath, margin entire, base oblique, apex usually mucronate; petioles 1–3 mm. long; stipules distinct or ventral more or less united toward apex of stem, subulate to triangular-subulate, entire or few-parted; cyathia solitary at the upper nodes; peduncles 0.5–5 mm. long; involucres obconical-campanulate, 1–1.4 mm. in diam., glabrous without, with a ring of short hairs within at the level of the intervals between lobes and glands, sometimes extending downward beneath the glands; lobes triangular, acuminate, mostly



Map 1, range of Euphorbia Abramsiana in the U. S.; 2, E. glomerifera in the U. S.; 3, E. polycarpa var. hirtella in the U. S.; 4, E. polycarpa var. typica in the U. S.; 5, dots E. polycarpa var. typica and var. hirtella intergrades, circles E. polycarpa var. simulans; 6, E. pediculifera var. typica in the U. S.; 7, dots E. serrula in the U. S., circles E. theriaca; 8, dots E. revoluta, circles E. platysperma; 9, E. Parryi; 10, dots E. maculata in Canada and the U. S., circles E. gracillima; 11, E. indivisa in the U. S.; 12, E. melanadenia in the U. S.; 13, dots E. missurica var. intermedia, circles E. missurica var. typica, half filled circles intergrades between E. missurica vars. typica and intermedia; 14, E. serpyllifolia var. hirtula in U. S.; 15, E. serpyllifolia var. genuina in U. S. and Canada; 16, E. villifera var. typica in the U. S.; 17, E. florida in the U. S.

entire, slightly exceeding the glands, proximal often narrower; glands 0.3–0.4 mm. long, broadly transversely oval to subcircular or sometimes nearly double and figure-eight-shaped, shallowly cupped; appendages rudimentary or absent; fifth gland small or absent, the involucre irregular and the parts difficult to identify in this interval; sinus narrowly U-shaped to V-shaped, little depressed; bracteoles glabrous, united below, free above, forming a three- to several-parted tangential structure between and outside the fascicles, shorter than the androphores; staminate flowers 1–3 per fascicle, 5–14 per cyathium, or some of the uppermost cyathia with staminate flowers abortive or wanting; androphores 0.8–1.3 mm. long, glabrous; gynophore glabrous, soon exserted and reflexed; ovary roundly 3-lobed; styles 0.7–1 mm. long, bifid to the middle, mostly closely reflexed; capsules 3–3.5 mm. long, roundly 3-lobed, broader below the equator; seeds compressed-ovoid, base subtruncate, apex subacute, back strongly rounded, face slightly rounded, 2–2.6 mm. long, 1.6–1.9 mm. tangentially, 1–1.6 mm. radially, coat white, irregularly cellular-reticulate microscopically, the brown microfavose macroscopically smooth testa showing through.—Plate 654A.

Sandy or gravelly beaches above high tide and sand dunes, both maritime and lacustrine, Magdalen Islands, Quebec, south to Georgia; shores of Lake Ontario, Erie, Michigan and the southern tip of Lake Huron; introduced in western Europe (Map 42). Representative specimens seen: Quebec. Gaspé Co.: near the Lobster Hatchery, Grindstone, Magdalen Islands, *Fernald, Long & St. John 7720* (G, Ph). Prince Edward Island. Prince Co.: near Campbell's Pond, Malpeque, *Fernald & St. John 11114* (G); Lower Sea Cow Pond, *Fernald, Long & St. John 7719* (G, Ph, US). Queens Co.: Grand Tracadie, *Fernald, Long & St. John 7722* (G, Ph, US); Brackely Point, *Fernald, Long & St. John 7721* (G, Ph). Nova Scotia. Cape Breton Co.: Sydney Mines, *Bissell & Linder 21755* (G, Ph, NY). Pictou Co.: Little Cariboo Island, *C. B. Robinson 187* (NY). Cumberland Co.: Linden, Aug. 11, 1885, *Trueman* (G). Queens Co.: Central Port Mouton, *Graves, Long & Linder 21754* (G, Ph, US). New Brunswick. Charlotte Co.: Long Pond Beach, Grand Manan, *Weatherby 5700* (G). Gloucester Co.: Tracadie Beach, *Blake 5651* (G, NY, US). Maine. Knox Co.: Matinicus, *C. A. E. Long 74* (NE). Cumberland Co.: Brunswick, railroad track, Sept. 21, 1907, *Kate Furbish* (NE). Sagadahoc Co.: Popham Beach, Aug. 6, 1894, *Fernald* (G, NE). York Co.: between Cutts Island and Gerrish Island, Kittery, *Fernald & Long 13994* (NE, Ph); Old Orchard, *Fernald 2733* (NE). New Hampshire. Rockingham Co.: Little Harbor, Rye, Sept. 19, 1901, *E. F. Williams* (G); Hampton, Oct. 5, 1901, *Knowlton* (G, NE). Massachusetts. Essex Co.: Salisbury, *D. White 296*

(NE); Plum Island, Newbury, *Pease 2716* (G); Rockport, Aug. 14, 1898, *E. F. Williams* (NE). Suffolk Co.: Revere Beach, *Pease 9858* (NE). Norfolk Co.: Quincy (Rufe's Hummock), Sept. 4, 1894, *Fuller* (NE); Cohasset, sand by shore, Aug. 9, 1882, *Deane* (NE). Plymouth Co.: Scituate, Sept. 17, 1893, *S. Harris* (NE); Marshfield, Aug. 9, 1897, *Morss* (NE); Duxbury Beach, *St. John 787* (NE); Plymouth, *Fernald, Hunnewell & Long 9818* (NE, Ph); Wareham, *Fernald & Long 9821* (NE, Ph). Barnstable Co.: Barnstable, Sept. 16–17, 1916, *Bean, Bird & Knowlton* (NE, Ph); Brewster, *Fernald & Long 17038* (NE); Truro, Aug. 6, 1896, *Rich* (NE); Provincetown, *Fernald & Long 18584* (NE, Ph); Wellfleet, Sept. 4, 1916, *F. S. Collins* (NE); Hyannis, *Fernald, Butters & St. John 15261* (NE); Woods Hole, *Safford 233* (US). Bristol Co.: Dartmouth, *Collins 2872* (NE). Dukes Co.: South Shore, Nonamesset Island, *Fogg 2870* (NE); Nashawena, Elizabeth Islands, July–Aug., 1901, *Northrop* (NY); Edgartown, Marthas Vineyard, *Fernald* in *Pl. Exs. Gray. 69* (G, M, NE, NY, Ph, US). Nantucket Co.: Wauwinet, *Churchill 545* (G, M); Tuckernuck Island, Aug. 6, 1909, *Cushman* (Ma); Nantucket, 1912, *Brewster* (NE); Coatue, Aug. 12, 1933, *Wyatt & Franklin* (Ma); southwest beach, Nantucket Island, July 20, 1910, *Cushman* (Ma). Rhode Island. Newport Co.: Prudence Island (Portsmouth), *Sanford 10384* (NE); Block Island, *Fernald & Long 9817* (G, NE, Ph). Kent Co.: Greens Island, Warwick, Aug. 13, 1921, *Hope* (NE). Washington Co.: Quonochontaug, Oct. 12, 1919, *Hope* (NE); Westerly, Aug. 31, 1919, *Weatherby & Collins* (NE). Connecticut. New London Co.: Old Lyme, Sept. 29, 1917, *Woodward* (NE). New Haven Co.: New Haven, *Blewitt 849* (NE); Orange, *Bissell 528* (NE); Guilford, July 30, 1906, *Bartlett* (G). Fairfield Co.: Bridgeport, Sept. 4, 1898, *Eames* (G). New York. Suffolk Co.: Fishers Island, *St. John 2787* (G); Riverhead, Long Island, *St. John 2788* (G); Southampton, Long Island, *Clute 257* (NY). Nassau Co.: Sand's Point, Long Island, Oct. 9, 1876, *E. G. Knight* (NY). Queens Co.: Laurelton, Long Island, *Moldenke 2931* (NY). Jefferson Co.: along shore of Lake Ontario near Woodville, *House 16990* (G). Oswego Co.: north spit, west of North Sand Pond, *House 19977* (US). Monroe Co.: Windsor Beach, *Bartram 1793* (NY, Ph). Erie Co.: Buffalo, *Williamson 2418* (Ph). New Jersey. Middlesex Co.: Long Branch, 1852, *Short* (Ph). Monmouth Co.: Sandy Hook, Aug. 15, 1887, *Stabler* (G). Ocean Co.: below Mantoloking, sand dunes, Aug. 11, 1902, *Lyons* (US). Atlantic Co.: Atlantic City, *Gross 2498* (NY). Cape May Co.: Cape May, *Pennell 2214* (US). Salem Co.: along Delaware River, between Straight & Black Ditches, 3.75 miles west-northwest of Hancocks Bridge, *Fogg 7753* (G). Pennsylvania. Erie Co.: Presque Isle, Erie, Sept. 3, 1868, *Porter* (US); Presque Isle, Erie, Sept. 4, 1868,

Garber (Ph). DELAWARE. Kent Co.: ½ mile south of Smyrna River, *Larsen 1044* (US). Sussex Co.: Ellendale, along railroad, Aug. 29, 1908, *Williamson* (Ph); Rehoboth, *Larsen 425* (G, M, Ph); south of Bethany Beach, *Fogg 11208* (G). MARYLAND. Worcester Co.: Ocean City, *Killip 7343* (US). Baltimore Co.: Gunpowder River, *Plitt 857* (G). Calvert Co.: sandy shore, Chesapeake Beach, *House 371* (NY, US). St. Mary's Co.: beach, Tall Timbers, *Killip 32209* (G, US). VIRGINIA. Elizabeth City Co.: Fortress Monroe, 1879, *Vasey* (US). Northampton Co.: Savage Neck, *Fernald & Long 5350* (G, NY). Princess Anne Co.: Virginia Beach, *Heller 1231* (G, M, Ph, US); Cape Henry, *Kearney 1812* (US). NORTH CAROLINA. New Hanover Co.: Carolina Beach (below Wilmington), *Biltmore Herb. 3838*[a] (G, M, NY, US). Carteret Co.: Atlantic Beach, *R. K. Godfrey 6490* (G); Sold, Salter Path, Bogue Island, July 15, 1926, *Anonymous* (Ph). SOUTH CAROLINA. Charleston Co.: Isle of Palms, *Biltmore Herb. 3838*[b] (US). Beaufort Co.: Bulls Point Beach, St. Helena Island, *Cuthbert 707* (NY). GEORGIA. Chatham Co.: Tybee Island, *Harper 736* (NY, US). Glynn Co.: Saint Simons Island, *Biltmore Herb. 3838*[c] (US). ONTARIO. Prince Edward Co.: Wellington, Sept. 3, 1902, *Fowler* (G, US). Welland Co.: Point Abino, *Biltmore Herb. 3838*[d] (US), *McCalla 287* (US). Lambton Co.: Point Edward, *Macoun 88089* (G). MICHIGAN. St. Clair Co.: shore of Lake Huron, near Port Huron, Aug. 8, 1895, *C. K. Dodge* (G, US); Fort Gratiot, along St. Clair River, July 20, 1870, *Gillman* (G). Leelanau Co.: ¾ mile east of shore of Lake Michigan, Glen Haven, *Hermann 2248* (G). Berrien Co.: Harbert, *Johnson 1132* (US); lake shore, St. Joseph, Aug. 10, 1838, *Houghton* (NY). OHIO. Lake Co.: Lake Erie, Salida Beach, *Webb 1436* (G). Cuyahoga Co.: Lake Erie, Cleveland, 1840, *Sullivant* (Ph). Erie Co.: lake shore, Vermilion, Sept. 16, 1895, *Dick* (US); Lake Erie, Cedar Point, July 17, 1914, *MacDaniels* (G). INDIANA. Laporte Co.: frequent at Michigan City, *Deam 5206* (G, NY). Porter Co.: Lake Michigan, Mineral Springs, *Lansing 3359* (G, US); Dune Park, *V. H. Chase 205* (G, M), *A. Chase 2111* (US), *Umbach 1917* (Ph). Lake Co.: Lake Michigan, Miller's, Aug. 14, 1897, *Umbach* (US), Sept. 4, 1911, *Sherff* (G); Lake Michigan, Whiting, Aug. 18, 1897, *A. Chase* (Ph). WISCONSIN. Door Co.: Lake Michigan, Sturgeon Bay, *Fassett 18156* (G, M). Kewaunee Co.: Algoma, *Fassett & Wilson 14674* (G, M). Milwaukee Co.: Milwaukee, 1865, *Lapham* (G). Racine Co.: Racine, Sept. 1878, *Davis* (G). ILLINOIS. Lake Co.: Waukegan, *Gleason & Shobe 336* (G). Cook Co.: near shore, Sheridan Park, Chicago, *A. Chase 1896* (US). FRANCE: Gironde, sables maritimes, Soulac, Oct., 1903, *Pitard* (G).

2. EUPHORBIA PLATYSPERMA Engelm. ex S. Watson, Bot. Calif. **2:** 482. 1880. TYPE: Near the mouth of the Colorado

River, southern Arizona, 1869, *Ed. Palmer 2* (M 144649!; photographs G!, W!; ISOTYPES F!, G!, NY!, US!).

E. eremica Jepson, Man. Fl. Pl. Calif., 600, 1925. TYPE: Coachella Valley (Conchilla Desert), Riverside County, California, alt. ca. 200 feet, May, 1914, *Jepson 6074* (J!). According to Jepson in litt. "*Euphorbia eremica* was collected in the Conchilla Desert between Thousand Palms Canyon and Palm Springs, but much nearer the former place." This species was proposed without consideration of *E. platysperma* which was hidden in "Additions and Corrections to Vol. II".

Annual; stems prostrate, 1–1.5 mm. thick, slightly longitudinally wrinkled, 10–27 cm. long, very slightly glutinous, glabrous, internodes 1–3 cm. long; leaves yellowish green, glabrous; blades oblong to obovate, often mucronate, 5–10 mm. long, margin entire, base slightly oblique, midrib evident; petioles 1.5–2.5 mm. long; stipules glabrous, 1.5–2 mm. long, with two or three divisions, distinct, or united below toward stem-apex; cyathia solitary at the nodes; peduncles slightly angled, as much as 5 mm. long, glabrous; involucres glabrous without, glabrous within except for a tuft of short hairs below each gland and a small fringe at the base of each lobe, shallowly campanulate, 1.5–2 mm. in diam.; lobes equaling the glands, glabrous except within below, deltoid-truncate, apex entire or slightly bifid; glands mostly slightly radially elongate, 1 mm. wide, facing obliquely outward, sessile, outer margin sometimes produced into two short rounded lobes, i. e., emarginate, margin lighter color than the brownish inner portion but scarcely differentiated into an appendage; fifth gland subulate, half as long as the lobes, glabrous; sinus U-shaped, slightly depressed; bracteoles 1–1.5 mm. long, distinct, with a few short hairs above, forming a fringe of 20–25 bracteoles around the outside of each fascicle of staminate flowers, not adnate to the involucre; staminate flowers mostly 10 per fascicle, 50 per cyathium; androphores glabrous, 2 mm. long, exserted; gynophore glabrous, long-exserted and reflexed at maturity, slightly angled; ovary glabrous, scarcely lobed, carpels evidently channeled on back; styles stout, parted to the base, 0.5 mm. long; capsule rotund-ovoid, slightly 3-lobed, ca. 4 mm. long, glabrous, carpels slightly ridged on back; seeds white, microreticulate, 2.4–3 mm. long, 1 mm. radially, 1.7 mm. tangentially, broadly oblong radially, base truncate obliquely inward, apex with an inflexed mucro, back rounded, smooth, face with two smooth, flat, nearly approximate, slightly depressed facets separated by the elevated raphe.—PLATE 665D.

California to Arizona? (MAP 8).

Only the two above-cited collections of this species are known. Jepson found but one plant and Palmer appears likewise to have

found only one. The exact locality of Palmer's collection is uncertain. The data on labels vary. Some read merely "Southern Arizona", others "Near mouth of Colorado R.", and Engelmann's own "near the mouth of the Colorado River, Ariz."

This species is of particular phytogeographic interest in that it is seemingly an originally littoral species closely related to the common *E. polygonifolia* of the Great Lakes and Atlantic Coast. The rarity of this plant may well be due to the change from littoral to inland desert habitat caused by the geologically recent recession of the sea from the Salton Sink. The sea covered this area so recently that the old beach-line is plainly discernible and small delicate gastropod shells left lying on the desert have yet to disintegrate. Perhaps examination of the old beach line, particularly in sandy areas, will yield further collections.

3. Euphorbia ocellata Durand & Hilgard, Journ. Nat. Acad. Sci. ser. 2, **3:** 46. 1854.

Annual; stems prostrate, few to numerous, to 20 cm. long, often to 1.5 mm. diam., slightly longitudinally wrinkled, glabrous or pubescent, internodes 1–3 cm. long; leaves glabrous or pubescent, blades entire, ovate-deltoid-falcate, 4–10 mm. long, apex blunt or mucronulate, base oblique, midrib elevated beneath and lateral veins prominent, margin revolute, or ovate-lanceolate, 7–15 mm. long, acuminate, base obtuse and only slightly oblique, midrib not elevated below and lateral veins mostly obscure, margin plane; petioles 1.5–2 mm. long, amplexicaul on lower side of stem; stipules distinct or lower slightly united at the base toward the stem-tips, filiform or broader, entire or parted, glabrous or pubescent, 1–1.3 mm. long; peduncles stout, 2–4 mm. long, glabrous or pubescent; cyathia solitary at the nodes; involucres turbinate to campanulate, 1.5–2 mm. diam., five-lobed especially in the late season, glabrous or pubescent without, pubescent above within; lobes broadly deltoid, pubescent on inner side or both sides and opaque throughout or glabrous and hyaline above, variously toothed or nearly entire, equaling the glands; glands discoid or slightly radially elongate, 0.5–0.7 mm. diam., yellowish or reddish, on short stout stipes, glabrous or pubescent without and pubescent within; fifth gland linear, equaling the glands; glands exappendiculate or rarely with narrow white appendages; bracteoles nearly equaling the glands, in a group opposite each gland, more or less united below and adnate to the involucre, ca. 5–10 per group, tips heavily or sparsely beset with short stout hairs; staminate flowers 8–13 per fascicle, 40–60 per involucre; androphores 1.7–2 mm. long, glabrous, barely equaling or mostly

shorter than the glands; gynophore glabrous or with short hairs above, long-exserted and usually reflexed at maturity; ovary three-angled, glabrous or pubescent; style ca. 0.5 mm. long, parted to the middle, glabrous throughout or pubescent below, divisions terete; capsules strongly three-lobed, 2–2.3 mm. long, broader than long, glabrous or with short spreading hairs, carpels rounded on the back and mostly with a very low channeled ridge on the back; seeds ovoid, with lateral angles barely visible or wanting, or turgidly quadrangular, suborbicular to ovate-acute radially, 1.4–1.7 mm. long, 1.1–1.3 mm. radially and tangentially, smooth to rugose, coat white, microreticulate, sometimes little obscuring the brown to gray testa.

Key to Varieties

Herbage glabrous.
  Median leaves ovate-lanceolate, not at all or very slightly falcate, acuminate, usually without evident lateral veins; seeds always smooth . . . . .c. var. *arenicola*.
  Median leaves ovate-deltoid-falcate, blunt or mucronulate, lateral veins evident below; seeds often rugulose or rugose. . a. var. *typica*.
Herbage pubescent . . . . .b. var. *Rattanii*.

3a. E. ocellata D. & H., Journ. Nat. Acad. Sci. ser. 2, **3:** 46. 1854, var. typica L. C. Wheeler, Bull. Torr. Bot. Club **63:** 402. 1936. Type: Poso Creek, Kern County, California, *Dr. A. Heermann* (Ph!, possibly only isotype; photographs G!, W!). An average member of the species. Durand & Hilgard, Rep. Expl. Miss. R. to Pacific Ocean **5** (**3**): 15, t. 18. 1855, seed bad.—*Chamaesyce ocellata* (D. & H.) Millsp., Field Mus. Pub. Bot. **2:** 410. 1916.

Chamaesyce sulfurea Millsp., Field Mus. Pub. Bot. **2:** 405. 1916. Type: hills near Big Chico Creek, east of Chico, Butte County, California, Sept. 16, 1913, *A. A. Heller 11140* (F 411411!; photographs G!, W!; isotypes C!, D!, G!, M!, Ph!, US!). A local race with rugose-tuberculate seeds, seemingly too ill-defined for recognition.—*E. ocellata* D. & H. var. *sulfurea* (Millsp.) Jepson, Fl. Calif. **2:** 427. 1936.

Glabrous except within the involucre; median leaves ovate-deltoid-falcate, 4–10 mm. long, apex blunt or mucronulate, base oblique, midrib conspicuous, elevated, lateral veins evident, margin revolute; glands exappendiculate; seeds smooth to rugose, back and lateral angles visible.—Plate 665A.

Cismontane valleys of California from Shasta County south to San Bernardino County (Map 22). Representative specimens seen: California. Siskiyou Co.: Dunsmuir, *Jepson 6159* (J). Tehama Co.: near Red Bluff, northeast side of Sacramento River, in the low hills, *Jepson 15279a* (J). Contra Costa Co.: Mount Diablo, *Jepson 13926* (J). Stanislaus Co.: La Grange, *Jepson 13925* (J). Monterey Co.: Jolon, *Vasey 577* (Ph).

Fresno Co.: Rancho Cantua, Cantua Creek, Sept., 1908, *Lillis* (J). Tulare Co.: Halstead's Ranch to Davis Ranch, north fork of Kaweah River, Sierra Nevada, *Jepson 577* (J). Kern Co.: Cottonwood Creek on River Road, between Bakersfield and Bodfish, *Abrams 5341* (NY); near Havilah, *Coville & Funston 1081* (US). San Bernardino Co.: sandy plains, Colton, 1882, *Pringle* (G, NY, Ph). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 403. 1936.

This entity is very uniform throughout most of its range. The plants of the San Bernardino region, though probably isolated at the same time as those of the Mohave Desert, show no significant differences from those of the Central Valley. Incidentally, collectors would do well to search for this plant near San Bernardino. Parish made several collections in this vicinity before 1900 but recent collectors have not found it. The uncultivated brushy plain northwest of Slover Mountain and north of Jurupa Mountains (Hills) is a likely place. The specimen from Dunsmuir in the Sacramento River canyon is probably a chance introduction. The small leaves, long internodes, and slender stems support this supposition.

At the extreme north end of its range *E. ocellata* breaks into local races. Var. *Rattanii*, q. v. infra, is the best marked. Var. *sulfurea* (Millsp.) Jepson is one of these ill-defined local races. I have no particular quarrel with anyone wishing to recognize it. Collectors will do well to secure a close series of *E. ocellata* at the north end of the Sacramento Valley around Chico and Oroville in order to determine the stability and range of var. *sulfurea* and the race north of Oroville. This race, which is usually readily recognizable by color, occurs at Table Mt. Olive Ranch, 7 miles north of Oroville, Butte Co. and is well represented by *A. A. Heller 11143* (C, G, M, NY, Ph, US). Another collection made at apparently the same place and season three years later, *Heller 12645* (F, G, M, NY, Ph, US) largely lacks the reddish cast but the foliage agrees fairly well in shape. The foliage and long internodes of this Oroville race bear a close resemblance to the var. *sulfurea* of the foothills near Chico. But the seed coats of the Oroville plants are only very slightly wrinkled instead of strongly rugose as in var. *sulfurea*. The plants of this Oroville race are usually reddish in color. Otherwise the species is yellow-green throughout except for some individuals of the pubescent

var. *Rattanii.* Besides the elongate internodes the Oroville facies differs from var. *typica* in the slightly larger and less falcate leaves.

3b. E. ocellata D. & H. var. Rattanii (S. Wats.) L. C. Wheeler, Bull. So. Calif. Acad. Sci. **33:** 107. 1934.—*E. Rattanii* S. Wats., Proc. Amer. Acad. Arts & Sci. **20:** 372. 1885. Type: Stony Creek, Glenn County (formerly part of Colusa Co.), California, June 1884, *V. Rattan 57* (G!, fragment F!).—*Chamaesyce Rattanii* (S. Wats.) Millsp., Field Mus. Pub. Bot. **2:** 411. 1916.

Like variety *typica* but the herbage beset throughout with short stout hairs; upper half of the gynophore, the ovary, and styles pubescent in like manner; glands often with very narrow white appendages; seeds turgidly quadrangular, ovate-acute radially.—Plate 665B.

Local in the Lower Stony Creek drainage, Glenn Co., California (Map 24). Additional specimens seen: California. Glenn Co.: Stony Creek, two miles north of Orland, *L. C. Wheeler 4041* (CL, Peir, P, W); gravelly bed of a large winter stream 5 miles east of Newville, *A. A. Heller 11555* (C, CA, D, F, G, M, NY).

This is certainly an incipient species. With only the type Watson was fully justified in believing it a distinct species for, in addition to the presence of appendages and pubescence, the seeds of the type are all dark gray and evidently angled. But in my collection made at the type locality some seeds were distinct as in the type but others matched those of var. *typica.*

3c. E. ocellata D. & H. var. arenicola (Parish) Jepson, Man. Fl. Pl. Calif., 600. 1925.[1] *E. arenicola* Parish, Erythea **7:** 93. 1899. Type: Camp Cady (Sink of the Mohave River on some labels), Mohave Desert, San Bernardino County, California, *S. B. & W. F. Parish 1370* (D!; isotypes C!, F!, G!, M!, Ph!, US!).—*Chamaesyce arenicola* (Parish) Millsp., Field Mus. Pub. Bot. **2:** 408. 1916.—*E. cuspidata* Engelm. ex Parish, Erythea **7:** 93. 1899, in synonymy; not A. Bertoloni, Misc. Bot. **2:** 9. 1843.

Leaves ovate-lanceolate, acute, to 15 mm. long, base slightly oblique, midrib straightish, not elevated below, lateral veins mostly obscure; seeds strictly ovoid or the back and lateral angles slightly evident, very smooth.—Plate 665C.

Mohave Desert, California, east to Nevada, Utah, and northwestern Arizona (Map 22). California. Inyo Co.: Searle's Lake, *Jepson 7144* (J). San Bernardino Co.: sand hills, Soda

[1] Title-page date questionable but here accepted as no conflict as to priority is involved.

Lake, *Parish 10375* (CA, F, J). NEVADA. Washoe Co.: Wadsworth, *Kennedy 918* (C, D, M, NY, US). Churchill Co.: Fallon, *Headley 42* (US). Truckee Desert, *S. Watson 1077* (US). UTAH. near Pahvant Butte, *J. A. Harris 2534* (G). ARIZONA. Mohave Co.: Virgin River, *Purpus 6187* (C, NY). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 404. 1936.

4. EUPHORBIA PARRYI Engelm., Amer. Nat. **9:** 350. 1875. TYPE: loose drifting sand, St. George, Washington County, Utah, 1874, *C. C. Parry 274* (M 144658!; photographs G!, W!; ISOTYPE G!). Rather small plants.—*Chamaesyce Parryi* (Engelm.) Rydb., Bull. Torr. Bot. Club **40:** 53. 1913.

E. petaloidea Engelm. δ *flagelliformis* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**)**:** 185. 1859. TYPE: valley of the Rio Grande near Frontera, subsaline sandy soil, El Paso County, Texas, July 26, 1851, *C. Wright 1826* (M 149817!; photographs G!, W!; ISOTYPE G!). Large plants.—*E. zygophylloides* Boiss. var. *flagelliformis* (Engelm.) Engelm. ex Boiss. in DC. Prod. **15**(**2**)**:** 29. 1862.—*E. flagelliformis* (Engelm.) Engelm. in T. S. Brandegee, Bull. Geol. Geogr. Surv. Terr. **2:** 243. 1876.—*Chamaesyce flagelliformis* (Engelm.) Rydb., Bull. Torr. Bot. Club **33:** 144. 1906, Bull. Colo. Agr. Exper. Sta. **100:** 223. 1906 (Fl. Colorado).

E. longeramosa S. Watson, Proc. Amer. Acad. Arts & Sci. **25:** 161. 1890. TYPE: sand hills near Samalayuca, Chihuahua, Mexico, Sept. 13, 1888, *C. G. Pringle 2000* (G!; ISOTYPE M!). Large plants like type of *E. flagelliformis*.—*Chamaesyce longeramosa* (S. Wats.) Millsp., Field Mus. Pub. Bot. **2:** 410. 1916.

Annual, glabrous; stems prostrate to erect, 5–70 cm. long, leaves 5–28 mm. long, linear, entire, aequilateral, shortly petiolate; stipules distinct, linear, entire or parted; cyathia long-peduncled; involucres cupuliform-campanulate, 1.5–1.75 mm. in diam.; glands 0.3–0.5 mm. long, transversely oval, cupped; fifth gland linear, equaling the glands; sinus very broadly U-shaped, not depressed; appendages narrow, white, glabrous, entire, margining all except the inner side of the gland, ascending; androphores 40–55, 1–1.2 mm. long; capsule deeply 3-lobed to bluntly 3-angled, oblate-spheroid, 2 mm. long; seeds ovoid-triangular, 1.8 mm. long, narrowly ovate radially, mottled brown and white.—PLATE 654D.

Southwestern Colorado; Utah and Nevada; San Bernardino County, California; Arizona; New Mexico; Western Texas; and northern Chihuahua, Mexico (MAP 9). Representative specimens seen: COLORADO. Montezuma Co.: sandy plains, San Juan Valley, 1875, *T. S. Brandegee* (M). UTAH. Grand Co.: 5 miles west of Moab on desert, *Maguire & Redd 1958* (I, M). Kane Co.: Kanab, in sand, *Jones 6044* (M, NY). Washington Co.: 2½ miles west of Toquerville, *B. Maguire, Ruth Maguire & G. Piranian 12315* (G, I); Anderson's Ranch, *Maguire & Blood 1435*

(I). San Juan Co.: Copper Canyon, 2 miles from San Juan River, *Cutler 2286* (US); Wayland farm, Cottonwood Canyon, Bluff, *Maguire, Richards & Hammond 5744* (I); San Juan River near Montezuma Creek, *Eastwood 137* (G). Nevada. Clark Co.: near Moapa, *Train 1875* (N). California. San Bernardino Co.: Devil's Playground near Kelso, June, 1905, *K. Brandegee* (C); sand dunes near Kelso, May 15, 1939, *Jaeger* (G). Arizona. Mohave Co.: sand dunes, Beaver Dam Creek, Virgin River, *Goodding 759* (G, M, NY, US). Coconino Co.: Moqui Village, Aug., 1891, *Owens* (G); cindery soil near Tolchaco, *H. C. Hanson A210* (M, NY). Navajo Co.: Holbrook, *Rusby 827* (F, NY, Ph, US); Winslow, *Peebles 9599* (US). Apache Co.: Adamana, Sept. 1, 1909, *Rusby* (NY); Billings, on Puerco River, *Jones 4720* (I, NY, US). Graham Co.: Camp Goodwin, Gila Valley, *Rothrock 339* (M, US). Cochise Co.: Bowie, Sept., 1884, *Jones* (US); near Wilcox, Sept. 8, 1914, *Shreve* (W). New Mexico. Doña Ana Co.: 2 miles northwest of San Miguel, *Fosberg S3785* (G, O); Straus' Station, 1912, *Stearns* (M). Socorro Co.: Sabinol, *Wooton 349* (M). Texas. El Paso Co.: *Cory 1922* (G). MEXICO. Chihuahua: 36 miles south of Ciudad Juarez, *Shreve 7922* (W); Sapio, Sierra Madre, Sept. 10, 1903, *Jones* (M, US); Colonia Diaz, *Nelson 6455* (US).

5. Euphorbia ammannioides HBK., Nov. Gen. & Sp. **2:** 55 (quarto), 44 (folio). 1817.[1] Type: In arenosis, Cumana, Venezuela, *Bonpland 406* (Herb. Mus. Paris; fragment F!, photograph G!).—*E. maritima* Willd. ex Boiss. in DC. Prod. **15** (**2**): 28. 1862, in synonymy.—*Chamaesyce ammanioides* (HBK.) Small, Fl. Se U. S., 709, 1333. 1903.

Chamaesyce Ingallsii Small, Fl. Se U. S., 708, 1333. 1903. Type: New Orleans, Louisiana, 1835, *Dr. Ingalls* (NY!, photographs G!, W!).—*E. Ingallsii* (Small) Cory, Rhodora **38:** 406. 1936.

Glabrous annual; stems usually prostrate, 4–40 cm. long, mostly 1–2 mm. thick, internodes 0.5–4.5 cm. long; leaf-blades 4–15 mm. long, mostly narrowly to broadly oblong, occasionally elliptic-oblong, apex sometimes mucronate, usually obtuse, base obtuse, inequilateral; petioles 1–2 mm. long; stipules glabrous, 1–1.3 mm. long, distinct, parted into usually 3 linear segments; peduncles short; cyathia solitary at the nodes; involucre obconical-campanulate, 1.2–1.6 mm. in diam., glabrous outside, short-hairy at the summit inside; lobes triangular, acuminate, tips glabrous, slightly exceeding the glands; glands subcircular to transversely elliptical or oblong, 0.4–0.6 mm. in diam., slightly cupped; appendages mostly narrower than the

[1] See J. H. Barnhart, Dates of the "Nova Genera" of Humboldt, Bonpland and Kunth, Bull. Torr. Bot. Club **29**: 585–598. 1902. The name, originally printed as *E. amannioides*, corrected to *E. ammannioides* by HBK. op. cit. **7**: 294 (quarto). 1825.

glands, rarely up to twice as wide; 5th gland linear, rarely of two parallel linear segments, ½ as long as to equaling the lobes; sinus U- to V-shaped, slightly depressed; bracteoles numerous, linear, often somewhat united below, glabrous below, short-hairy above, between and outside the staminate flowers, some adnate to involucre beneath the glands, a little shorter than the androphores; staminate flowers 5–16 per cyathium; androphores 1.4–2 mm. long, glabrous; gynophore glabrous, soon exserted and reflexed; ovary roundly 3-lobed; styles 0.35–0.5 mm. long, thick, bifid to about the middle, mostly clavate; capsule 2–2.1 mm. long, broader than long, wider below the equator, strongly roundly to subacutely lobed; seeds ovoid sub-triangular, 1.5–1.9 mm. long, 1.3–1.5 mm. tangentially, 1.3–1.5 mm. radially, coat mottled white, microreticulate.—Plate 654B.

Coastal sands: southern Virginia, North Carolina, Florida west to Texas; northern South America (Map 39). Representative specimens seen: Virginia. York Co.: York River northwest of Yorktown, *Fernald & Long 7510* (G); York River above Yorktown, *Fernald & Long 12703* (W). Surry Co.: inner border of sand-beach of Cobham Bay, James River, northwest of Chippokes, *Fernald & Long 12705* (W). Isle of Wight Co.: inner border of sandy beach, Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), *Fernald & Long 12706* (W); inner border of sand beach along James River, Ragged Island, northeast of Carrollton, *Fernald & Long 12704* (W). Princess Anne Co.: Virginia Beach, *Heller 1231* (NY). North Carolina. Carteret Co.: sand banks near Beaufort, *Lewis 164* (NY). Florida. Duval Co.: Pablo Beach, *Lighthipe 427* (NY). Volusia Co.: Mosquito Inlet, *Moldenke 5301* (NY). Dade Co.: beach opposite Miami, *Small 2113* (NY). Lee Co.: seashore, Punta Rassa, *A. S. Hitchcock 320* (F, G, M, NY). Manatee Co.: Palmetto, *Nash 2448* (G, NY); Snead's Island, *Tracy 6376* (G, M, NY). Pinellas Co.: St. Petersburg, Aug. 5, 1894, *Lewton* (NY). Mississippi. Jackson Co.: Horn Island, *Tracy 4717* (NY); Dog Key, *Tracy & Earle 2882* (NY). Harrison Co.: Cat Island, *Lloyd & Tracy 207* (NY). Louisiana. Quemines Co.: Battledore Island, *Lloyd & Tracy 214* (G, M, NY). Jefferson Co.: south central Grande Isle, *Cangemi & Andrus 1* (NY). Texas: Cameron Co.: Boca Chica, *Clover 356* (NY).

Boissier in DC. Prod. **15 (2)**: 28. 1862 included *E. bombensis* Jacquin, Enum. Pl. Carib., 22, 1760 (not seen, but ed. 2, 1762 examined), Select. Stirp. Amer. Hist., 151. 1763, as a possible synonym, judging by the description, of *E. ammannioides*. I draw the same conclusion. However, until some of Jacquin's specimens of this species are located, I hesitate to use the name since

the description is too vague to apply to any one species with certainty.

E. ammannioides presents a very puzzling problem, not only in its marked similarity to and close relationship with *E. Geyeri* but also in its internal heterogeneity. Floridan, Mississippian, and Louisianan specimens examined present, with but two exceptions, a reasonably uniform unit characterized by very narrow appendages, styles markedly clavate, and staminate flowers generally 5–7. The two exceptional collections are: Florida. Manatee Co.: Snead's Island, Sept. 10, 1899, *Tracy 6376* (NY). Dade Co.: Sand dunes opposite Miami, Mar. 7, 1915, *J. K. & E. W. Small 5869* (NY). The first has 10–15 staminate flowers and appendages sometimes as wide as the glands. The second has the glands virtually obsolete on some involucres and the lobes strongly inflexed, making the involucre 5-lobed. The Virginian specimens are rather stunted and can be fairly well matched in aspect, though not in technical details, by some specimens of *E. Geyeri*. The Texan plants, of which there are but two collections available, have 7, 9, 9, 15, and 16 staminate flowers per cyathium in the five counted. *Clover 356* is particularly marked in its general coarseness and its appendages up to twice as wide as the glands. It has the styles thickened below and slightly tapering. The fragment of the type of *Euphorbia ammannioides* has 15 staminate flowers in the one cyathium dissected, appendages from narrower than to a little wider than the glands, and thick, very slightly clavate styles. The type, from Venezuela, seems about intermediate between the Texan and Floridan plants.

Heller 1231 from Virginia is *Euphorbia polygonifolia* in some herbaria. *Fernald & Long 7510* was also probably *E. polygonifolia* in part, for seeds of that species were intermixed. Professor Fernald informs me that at all stations in Virginia where *E. ammannioides* has been found *E. polygonifolia* is also present. The latter is paler in color and more inclined to occupy the lower border of the beach, near high-water mark, while *E. ammannioides* characterizes the sands farther back from shore.

6. Euphorbia Geyeri Engelm. in Engelm. & Gray, Bost. Journ. Nat. Hist. **5:** 260. 1845. Type: Beardstown, Cass County, Illinois, Aug., 1842, *C. A. Geyer* (M 47878!; photographs G!,

W!; ISOTYPES G!, NY!).—*E. Geyeri* Engelm. var. *microsperma* A. Gray, Man. Bot. No. U. S. ed. 2, 386. 1856.—*Anisophyllum Geyeri* (Engelm.) Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 23. 1860.—*Chamaesyce Geyeri* (Engelm.) Small, Fl. SE U. S., 709, 1333. 1903.

E. polyclada Boiss., Cent. Euph., 10. 1860. TYPE: "Collection du Texas oriental, faite en 1848–49, recue en 1850," *C. Wright* (Ge!; photographs G!, W!). The Texan phase with slightly more blunt seeds.—*Chamaesyce polyclada* (Boiss.) Small, Fl. Se. U. S., 711, 1333. 1903.

Glabrous annual; stems several, mostly prostrate, occasionally erect, 6 to 37 cm. long, 0.4–1.4 mm. thick, internodes up to 3 cm. long, average about 1 cm.; leaf-blades oblong to ovate-oblong to elliptic-oblong, 4–10 mm. long, margin entire, base oblique, apex obtuse or emarginate, usually mucronate; petioles 1–2 mm. long; stipules distinct, or the ventral united, glabrous, ca. 1.5 mm. long, mostly parted into 3 filiform segments; cyathia solitary, sometimes somewhat clustered by the shortening of the uppermost internodes; peduncles up to 2 mm. long; involucres broadly campanulate, slightly tapering to the peduncle, 1–1.1 mm. in diam., glabrous outside, with a few hairs at the summit inside; lobes triangular, acuminate, tips glabrous, slightly exceeding the glands; glands broadly oval to subrotund, slightly cupped to folded, 0.2–0.6 mm. long; appendages white, from one half to twice as wide as the gland, rounded or sometimes pointed, entire or slightly toothed; fifth gland linear, hairy below inside, ⅔ as long as, to equaling the lobes; sinus U-shaped, not depressed; bracteoles forming a radial partition beneath each gland, adnate to the involucre nearly up to the base of the stipe of the gland but with inwardly branching linear segments scattered along the inner edge, segments linear, bearing a few to many hairs at the apex, about equaling the androphores, bracteoles in addition often forming a sheath, parted into hairy segments above, outside each fascicle; staminate flowers 1–5 per fascicle 5–17 per cyathium; androphores glabrous, 1–1.3 mm. long; gynophore glabrous, soon exserted and reflexed; ovary 3-lobed; styles 0.3–0.6 mm. long, ⅓–½ bifid; capsule 2 mm. long, roundly and deeply 3-lobed, wider below the equator, base truncate; seed ovoid-subtriangular, ovate to narrowly ovate radially, 1.3–1.6 mm. long, 1 mm. tangentially and radially, coat smooth, microreticulate, white but the brown testa often showing through.—PLATE 654C.

Sandy barrens or dunes mostly along rivers, Wisconsin, Illinois, Minnesota, Iowa, North Dakota, Nebraska, south to northern Texas, west to eastern Colorado and New Mexico (MAP 20). Representative specimens seen: WISCONSIN. Pepin Co.: open dunes, upper terrace, Pepin, *Fassett 10260* (G). Trempealeau Co.: Trempealeau, *Fassett & Wilson 5308* (G). La

Crosse Co.: La Crosse, 1861, *Hale* (M). Lancaster Co.: Boscobel, 1861, *Hale* (G, M, NY). Illinois. Lee Co.: Dixon, *Vasey* (G). Henderson Co.: banks of Mississippi River, near Oquawka, Sept. 18, 1871, *Patterson* (G). Mason Co.: Havana, Aug. 18, 1904, *Gleason* (G). Minnesota. Anoka Co.: Moore Lake, sand dunes, *Rosendahl & Rydberg 5135* (G, Mi). Wabasha Co.: open sand, Weaver, *Fassett & Hotchkiss 3437* (NY). Winona Co.: Winona, Aug. 1898, *Holzinger* (Mi). Hennepin Co.: St. Anthony, 1861, *Hale* (M). Iowa. Benton Co.: Vinton, 1876, *Davis* (M). Muscatine Co.: Moscow, Aug. 1887, *Hitchcock* (M). North Dakota. McHenry Co.: Denbigh, sand hills, Aug. 18, 1935, *Stevens & Kluender* (G). Nebraska. Holt Co.: Paddock, *Clements 2784* (G, NY). Thomas Co.: near Plummer Ford, Dismal River, sand hills, *Rydberg 1504* (G, NY). Brown Co.: Long Pine, Aug. 13, 1898, *Bates* (G). Kansas. Hamilton Co.: sand hills, *Hitchcock 466* (G, M, NY). Oklahoma. Payne Co.: sandy woods, *Oliver 137* (NY). Creek Co.: Sapulpa, *Bush 527* (G, M, NY). Texas. Dallas Co.: Dallas, 1878, *Reverchon* (M). Parker Co.: Weatherford, *Tracy 7860* (G, M, Mo, NY). Andrews Co.: Shafter Lake, *Cory 16614* (W). New Mexico. Roosevelt Co.: 2 miles west of Bledsoe, Cochran Co., Texas, *Cory 16525* (W). Colorado. Morgan Co.: sand hill 4 miles south of Brush, *Ramaley & Ewan 16326* (W).

7. Euphorbia missurica Raf., Atlantic Journ. **1:** 146. 1832; L. C. Wheeler, Proc. Biol. Soc. Wash. **53:** 10. 1940.

Annual, glabrous; stems decumbent to erect, 5–65 cm. long, internodes of the main branches mostly 2–5 cm. long; leaf-blades broadly oblong to linear, mostly 1–3 cm. long, margin entire, base symmetrical to slightly inequilateral, apex obtuse to retuse, often mucronate, petioles 1–3 mm. long; stipules linear to triangular-subulate, distinct to partially united, entire to parted, glabrous, 1–1.5 mm. long; peduncles 1–11 mm. long; cyathia solitary but sometimes in terminal cymes of 3–5; involucres campanulate, 1.7–1.9 mm. in diam., glabrous outside, pubescent within at the summit; lobes triangular, about equaling to slightly exceeding the glands; glands subcircular to transversely oblong, 0.4–0.7 mm. in diam., cupped or folded; appendages white to pink, mostly conspicuous, glabrous, radially ovate to oblong-ovate, entire to slightly emarginate; fifth gland of one or two linear segments from ⅔ as long as to about equaling the lobes, pubescent below; sinus U-shaped, little or not at all depressed; bracteoles from partly united below into a radial partition adnate below to the involucre to mostly free, mostly glabrous throughout, sometimes pubescent at the tips; staminate flowers 29–48 per cyathium; androphores glabrous, 1.4–1.9 mm. long; gynophore glabrous, well-exserted and reflexed; ovary glabrous, 3-lobed; styles ca. ½ bifid, 0.7–0.9 mm. long; capsule strongly

3-lobed, 2–2.5 mm. long, from about as broad as long to broader than long; seeds ovoid to broadly ovoid-triangular, 1.5–2 mm. long, 1.1–1.4 mm. tangentially and radially, rotundly ovate to ovate-acute radially, angles faint to evident but blunt, coat mottled whitish and brown.

Key to Varieties

Leaves broadly oblong to linear, apex obtuse to slightly retuse; ultimate branchlets mostly more or less capillary; seeds scarcely angled, micropylar area not markedly flattened and truncate; peduncles up to 11 mm. long, capillary.............a. var. *typica*.

Leaves linear, apex truncate, mostly emarginate; ultimate branchlets not capillary; seeds mostly definitely angled, micropylar area obliquely truncate; peduncles up to 4 mm. long, stouter......................................b. var. *intermedia*.

7a. E. missurica Raf., Atlantic Journ. **1:** 146. 1832, var. **typica.** Type: "Arkansa", *Nuttall* (NY!; photographs G!, W!). A fairly typical, though young, specimen.

E. zygophylloides Boiss., Cent. Euph., 10. 1860. Type: None of the original specimens from which Boissier drew his description has been seen. Consequently it seems inadvisable to select any type. The interpretation is certain since two of the numbers cited by Boissier have been seen at M.—*Chamaesyce zygophylloides* (Boiss.) Small in Britton & Brown, Ill. Fl. No. U. S. & Canada ed. 2, **2:** 161. 1913.

E. arenaria Nutt., Trans. Amer. Philos. Soc., n. s. **5:** 171. 1837, not H.B.K., Nov. Gen. et Sp. **2:** 57 (quarto), 45 (folio). 1817. Type: "Arkansa", [*Nuttall*?] (Ph!, perhaps only isotype; photographs G!, W!). Engelm. & Gray, Bost. Journ. Nat. Hist. **5:** 260. 1845 (Pl. Lindh.).—*E. petaloidea* γ *Nuttallii* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 185. 1859.—*E. Nuttallii* (Engelm.) Small in Britton & Brown, Ill. Fl. No. U. S. & Can. **2:** 371. 1897.—*Chamaesyce Nuttallii* (Engelm.) Small, Fl. SE U. S., 711, 1333. 1903.—Plate 666B.

Missouri, northwestern Arkansas, Kansas, south to Texas (Map 13). Representative specimens seen: Missouri. Barry County: Eagle Rock, *Bush 75* (M, NY). Cass Co.: July, 1865, *Broadhead* (M). Henry Co.: 3 miles northeast of Finey, *Steyermark 15972* (M, Mo). Jackson Co.: Greenwood, *Bush 10336A* (M, NY); Dodson, *Bush 506* (M, NY); Cockrell, *Bush 6487A* (M); Westport, Sept. 13, 1896, *K. K. Mackenzie* (M, Ph). Stone Co.: along east side of White River, south of mouth of Big Creek, north of Mill Creek, *Steyermark 19642* (M, Mo). Arkansas. Carroll Co.: Beaver, *E. J. Palmer 6333* (M). Kansas. Ellis Co.: near Hays, *Bondy 291* (M, Mo). Geary Co.: Junction City, *A. Brown 178* (NY). Miami Co.: Paola, *Oyster 7306* (NY). Osage Co.: Osage City, Aug., 1890, *Bodin* (NY). Riley Co.: Stony hills, *Norton 468* (M, NY). Oklahoma. Comanche Co.: Fort Sill,

Clemens 11671 (M). Johnston Co.: Tishomingo, *E. J. Palmer 6426* (M). Kiowa Co.: Wichita Mountains, July 27, 1891, *Sheldon* (M). Love Co.: Marietta, *E. J. Palmer 10406* (M). Murray Co.: Platt National Park, Bromide Hill, *G. M. Merrill 676* (NY). Ottawa Co.: near Miami, *G. W. Stevens 2344* (NY). Pawnee Co.: Cleveland, *E. J. Palmer 6379* (M). Payne Co.: 18 miles southeast of Stillwater, *Stratton 206* (M). Texas. Austin Co.: Industry, July, 1844, *Lindheimer* (M, Ph). Bexar Co.: near Bracken, *Groth 55* (NY). Burnet Co.: 3.1 miles north of Burnet, *Cory 15617* (W). Dallas Co.: Dallas, *Bush 1140* (M, NY). Gillespie Co.: Squaw Creek, *Jermy* (M). Grimes Co.: Anderson, *G. L. Fisher 37217* (F). Hays Co.: San Marcos, *Stanfield* (NY). Houston Co.: Grapeland, *E. J. Palmer 12832* (M). Parker Co.: Weatherford, *Tracy 8124* (M, Mo, NY, Ph). Tarrant Co.: Fort Worth, *Tracy 8168* (M, Mo, NY). Travis Co.: Austin, *Tharp 2854* (US). Washington Co.: Mill Creek, *Lindheimer 186* (M).

The Nuttallian rather than the James specimen is taken as type of *E. missurica* because the latter is a sterile seedling while the former *had* at least one cyathium from which Torrey drew the essential characters.

E. zygophylloides var. *cymulosa* Engelm. ex Boiss. in DC. Prod. **15 (2):** 29. 1862. This probably belongs here but the only apparently authentic material seen bore this varietal name but was placed under another species.

The intergradation between var. *typica* and var. *intermedia* is complete and there are plants which cannot be definitely assigned to either. Examples of such intergradation are the following collections:

Kansas. Barber Co.: Kiowa, *Rydberg & Imler 662* (NY). Cowley Co.: no loc., Aug. 3, 1898, *M. White* (NY). Oklahoma. Woods Co.: Alva, *G. W. Stevens 2960* (NY). Texas. Llano Co.: Llano, *E. J. Palmer 10285* (M).

7b. Euphorbia missurica Raf. var. intermedia (Engelm.) L. C. Wheeler, Proc. Biol. Soc. Wash. **53:** 11. 1940; based on *E. petaloidea* Engelm. β *intermedia* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2 (1):** 185. 1859. Type: Fort Pierre, Standley County, South Dakota, June 21, 1853, *F. V. Hayden* (M 149949!; photographs G!, W!).

E. petaloidea Engelm., l. c. Type: Forks of the Platte River, Lincoln County, Nebraska, July, 1858, *Henry Engelmann* (M 149966!; photographs G!, W!). Boiss. in DC. Prod. **15 (2):** 28. 1862; Small in Britton & Brown, Ill. Fl. No. U. S. & Canada **2:** 371. 1897, seeds poor.—*Chamaesyce petaloidea* (Engelm.) Small, Fl. Se. U. S., 711, 1333. 1903.

E. petaloidea α Nicolletii Engelm. in Emory, U. S. & Mex. Bound. Surv. **2 (1)**: 185. 1859. TYPE: mouth of Powder River, Yellowstone, Prairie County, Montana, July, 1854, *F. V. Hayden* (M 202539!).

Minnesota, west to eastern Montana, south to Texas and New Mexico (MAP 13). Representative specimens seen: MINNESOTA. Ottertail Co.: Clitherall, July, 1897, *J. E. Campbell* (M, Mi, US); sandy beach of Ottertail Lake, *Moyle 2333* (Mi); sandy shore of Battle Lake, *Rosendahl 4177* (Mi). NORTH DAKOTA. Slope Co.: Bad Lands, Marmarth, *L. R. Moyer 741* (Mi). SOUTH DAKOTA. Fall River Co.: Hot Springs, *Hayward 546* (NY). Potter Co.: Forest City, Sept., 1892, *T. A. Williams* (M). NEBRASKA. Banner Co.: *Rydberg 353* (NY). Brown Co.: Long Pine, *Conklin* (NY). Cherry Co.: Valentine Lakes Refuge, Aug. 10, 1937, *Tolstead* (W). Custer Co.: Anselmo, *Webber 11* (NY). Dawson Co.: Near Gothenburg, *Heller 14300* (M). Deuel Co.: July, 1890, *Rydberg* (NY). Hooker Co.: on Middle Loup River, near Mullen, *Rydberg 1372* (NY). Scott's Bluff Co.: Kiowa Valley, *Rydberg 353* (NY). Sioux Co.: *Kramer 152* (M). Thomas Co.: Dismal River, *Webber 2* (NY). KANSAS. Clark Co.: 10 miles south of Ashland, *Rydberg & Imler 747* (NY). Graham Co.: Bogue, *Imler 63* (M, NY). Grant Co.: Ulysses, *C. H. Thompson 60* (M, NY). Hamilton Co.: Syracuse, *Rose & Fitch 17099* (NY). Kearney Co.: 13 miles south west of Lakin, *Rydberg & Imler 919* (M, NY). Logan Co.: *A. S. Hitchcock 467a* (M, NY). Osborne Co.: Osborne City, *Shear 126* (NY). Reno Co.: Hutchinson, *Smyth 45* (US). Riley Co.: *Norton 467* (M, NY). OKLAHOMA. Alfalfa Co.: near Cherokee, *G. W. Stevens 622* (M). Beaver Co.: north of Beaver, *E. J. Palmer 41887* (M). Cleveland Co.: Norman, *Emig 525* (M). Harper Co.: north of Rosston, *G. J. Goodman 2197* (M). Payne Co.: 18 miles southeast of Stillwater, *Stratton 656* (M). TEXAS. Bailey Co.: 2 miles south of Muleshoe, *Ferris & Duncan 3422* (M, NY). Callahan Co.: Baird, *E. J. Palmer 14542* (M). Eastland Co.: 3½ miles east of Ranger, *Cory 13130* (W). Grayson Co.: Denison, *Stuart 147* (M). Hall Co.: Estelline, *Reverchon 3799* (M). Hartely Co.: 5.3 miles southwest of Middlewater, *Cory 16313* (W). Hemphill Co.: prairie north of Canadian, Aug. 10, 1900, *Eggert* (M). Hood Co.: Granberry, *Reverchon 3797* (M). Mitchell Co.: Colorado, *Tracy 8121* (M, Mo, NY). Motley Co.: 16.4 miles north of Matador, *Cory 16037* (W). Wilbarger Co.: Pease River near Vernon, *Ferris & Duncan 3353* (M). WYOMING. Natrona Co.: Alcova, *Goodding 161* (M, NY). COLORADO. Boulder Co.: Boulder, *Penard 301* (NY). Cheyenne Co.: S1, T14S, R51W, *Owenby 1350* (M, NY). Denver Co.: Denver, *Jones 292* (M). Huerfano Co.: La Veta, *Clements 152* (NY). Morgan Co.: 4 miles south of Brush, *Ramaley & Ewan 16325* (W). Weld Co.:

Crow Creek, *Pollard 92* (NY). New Mexico. Chaves Co.: 20 miles south of Roswell, *F. S. & E. S. Earle 279* (M, NY). Lea Co.: sandhills near Loving, *Standley 40362* (US). Union Co.: on the Cimarron, *Wislizenus 464* (M).

8. Euphorbia gracillima S. Watson, Proc. Amer. Acad. Arts and Sci. **21:** 438. 1886. Type: Hacienda San Miguel, near Batopilas, southwestern Chihuahua, Mexico, Aug., 1885, *Ed. Palmer 68* (G!). (Watson published the locality as "Hacienda San Jose" which seems to have been a *lapsus calami.*)—*Chamaesyce gracillima* (S. Wats.) Millsp., Field Mus. Pub. Bot. **2:** 409. 1916.

Glabrous erect annual 8–18 cm. tall; main stem up to 2 mm. thick at base, soon forking repeatedly into branches with internodes up to 2 cm. long below, progressively shorter toward the tips, ultimate branchlets ca. 0.1 mm. thick; leaves 2–15 mm. long; blades narrowly linear, margin entire, revolute; petioles 0.3–0.6 mm. long; stipules entire, distinct, glabrous, linear-subulate, 0.3–0.5 mm. long; cyathia solitary in the bifurcations; peduncles 0.3–0.9 mm. long; involucre turbinate, tapering to the peduncle, 0.5–0.7 mm. in diam., glabrous outside, with short hairs within at the summit; lobes triangular, acuminate, slightly exceeding the glands, ciliate on the margin; glands transversely oval, slightly cupped, 0.15–0.3 mm. long; appendages radially as long as glands or longer, slightly tapering and obtuse to bifid; 5th gland filiform, ca. ½ as long as the lobes or wanting; sinus U-shaped, little depressed; bracteoles linear, entire, glabrous or with a few short hairs above, slightly shorter than the androphores, one united to the involucre beneath each gland; staminate flowers 1–2 per fascicle, 5–12 per cyathium; androphores glabrous, included, 0.6–0.7 mm. long; gynophore glabrous, soon exserted and reflexed; ovary 3-angled, glabrous; styles ca. 0.5 mm. long, bifid; capsules glabrous, ca. 1.3 mm. long, sharply 3-angled, slightly wider below the equator, base truncate; seeds tetragonal, sharply angled, 1–1.1 mm. long, ca. 0.6 mm. radially and tangentially, radially narrowly ovate, acute, base truncate, facets all smooth, coat white but very thin, the brown testa scarcely obscured, with longitudinal rows of reticulations.—Plate 667A.

Arizona, south to Sinaloa, east to the Pacific slope of Chihuahua (Map 10). Representative specimens seen: Arizona. Pima County: Recreation Center, Tucson Mountains, *Shreve 6320* (Sh); Sells, *Harrison & Kearney 8037* (NY); near Tucson, *Harrison 8142* (A, US). MEXICO. Sonora: Bajada south of Las Trincheras, *Shreve 6375* (Sh); hills and mesas near Altar, Aug. 12, 1884, *Pringle* (G, US); San Bernardo, gravelly soil, alt. 250–300 m., *Pennell 19730* (US); Hermosillo, *M. E. Jones 22604* (possibly *21605*) (G); Chorijoa, Rio Mayo, in the sand, river bank, *Gentry*

1608 (G). Sinaloa: Culiacan, Sept. 8, 1904, *T. S. Brandegee* (G); Culiacan, Oct., 1904, *T. S. Brandegee* (US).

9. Euphorbia revoluta Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 186. 1859. Type: between Santa Fe and Moro (Mora?) River, in the mountains about the base of trees and shrubs, New Mexico, Aug. 10–16, 1847, *A. Fendler 789* (M 200216!; photographs G!, W!; isotype G!). Boiss., Icon. Euph., t. 13. 1866.—*Chamaesyce revoluta* (Engelm.) Small, Fl. SE U. S., 711, 1333. 1903.

Glabrous erect annual 3–20 cm. tall: main stem up to 2 mm. thick at the base, soon forking repeatedly into branches with internodes up to 3 cm. long below, progressively shorter toward the tips, ultimate branchlets 0.15–0.25 mm. thick; leaves 2.5–26 mm. long, largest leaves on any plant mostly over 1 cm. long; blades narrowly linear, margin entire, revolute; petioles 0.5–1.5 mm. long; stipules entire, distinct, glabrous, linear-subulate, attenuate, 0.3–0.8 mm. long; cyathia solitary in the bifurcations; peduncles 0.5–1.4 mm. long; involucres broadly obconical to turbinate, tapering to the peduncle, 0.9–1 mm. in diam., glabrous outside, with short hairs around the summit inside or glabrous; lobes triangular, acuminate, slightly to markedly exceeding the glands; glands subcircular, 0.15–0.3 mm. in diam., slightly cupped; appendages from a mere swelling beneath the gland to radially elongated and nearly as long as the gland; 5th gland linear, ca. half as long as the lobes; sinus V-shaped, little depressed; bracteoles linear, entire, or bifid, with a few short hairs above or glabrous, ca. ⅔ as long as the androphores, one united to the involucre beneath each gland; staminate flowers 1–3 per fascicle, 5–10 per cyathium; androphores 0.7–0.9 mm. long, glabrous, included; gynophore glabrous, soon exserted and usually reflexed; ovary 3-angled, glabrous; styles ca. 0.5 mm. long, entire or sometimes very shortly bifid, spreading, with erect tips; capsule glabrous 1.3–1.4 mm. long, sharply 3-angled, slightly wider below the equator, base truncate; seeds triangular-pyramidal to tetragonal, sharply angled, 1–1.3 mm. long, 0.7 0.9 mm. tangentially, 0.6–0.8 mm. radially, radially ovate-acute with truncate base, ventral facets concave and nearly smooth or face rounded, traversed by two (rarely 1) transverse rounded ridges, angles sharp, the ridges and valleys passing through them but slightly, or not at all, coat white, microreticulate, the brown testa sometimes showing through.—Plate 667B.

Colorado, New Mexico, Chihuahua, and Arizona (Map 8). Representative specimens seen: Colorado. Fremont County: Canyon City, *Clements 272* (NY); rocky hills near Canyon City, *Biltmore Herb. 6415* (US). New Mexico. San Miguel-Guadalupe County: between Anton Chico and Las Vegas, *Rose & Fitch 17638* (M, NY, US). Sandoval-Bernalillo County: Sandia

Mountains near La Luz Mine, *Ellis 335* (US). Sante Fe Co.: Santa Fe, *Rose & Fitch 17699* (M, NY, US). Lincoln County: Gray, *Skehan 118* (NY, US). Sierra County: 1 mile west of Hillsboro, *Metcalfe 1267* (G, M, NY, US). Doña Ana County: Little Mountain near Las Cruces, *Wooton 346* (M, US); west of the Organ Mountains, Sept. 1, 1908, *Wooton & Standley* (US). Grant County: Fort Bayard, *Mulford 943* (M, NY). Arizona. Mohave County: Kingman, Aug. 13, 1911, *Wooton* (US). Coconino County: northern foothill region of San Francisco Peaks, *Leiberg 5969* (US). Yavapai County: Clarksdale, *W. W. Jones C287* (G). Pima County: Davidson's Canyon, Sept. 8, 1884, *Pringle* (US). Gila County: Pinal Creek, *Harrison & Kearney 8291* (G). Santa Cruz County: Nogales, *Peebles, Harrison & Kearney 4589* (US). Cochise County: Bisbee, Oct. 4, 1890, *Lloyd* (G, US); Cave Creek, Chiricahua Mountains, *Harrison & Kearney 6164* (G). MEXICO. Chihuahua: near Colonia Garcia in the Sierra Madre, *Townsend & Barber 284* (M, US); hills near Chihuahua, *Pringle 999* (M); 6 miles east of Piloncillo, road from Jimenez to Camargo, via El Arroyo del Fierro, *I. M. Johnston 7874* (G).

Chas. Wright no. 1830 would have been taken as the type collection, as it was more widely distributed in herbaria than *Fendler 789*, if it were not for the fact that Asa Gray, in making up Wright's sets, combined two of Wright's collections under *no. 1830*. This fact is inferred from the presence in the pocket on one of the two sheets of this *no. 1830* at the Gray Herbarium of two of Wright's original collection-numbers. Omitting the details of the method of elimination, the data for the numbers are "298. Stony hills at the Copper Mines, Aug. 18, 1851", New Mexico; and "524. On the Sonoita near Deserted Rancho, Sept. 15, 1851", Santa Cruz County, Arizona.

10. Euphorbia florida Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**)**:** 189. 1859. Type: Valley west of the Chiricahua Mountains, Cochise County, Arizona, Sept. 8, 1851, *C. Wright 1829* (M 149820!; photographs G!, W!; isotype G!). Boiss., Icon. Euph., t. 14. 1866.—*Chamaesyce florida* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 409. 1916.

Glabrous erect annual 15–65 cm. tall; stem mostly branched from the base, rarely simple, 1–6 mm. thick at the base, internodes up to 7 cm. long, gradually shortened toward the stem tips; leaves linear, 1.5–6 cm. long or the uppermost much reduced in late season, margin remotely and sharply serrulate, revolute at least on drying, petioles 1.5–2 mm. long; stipules 1–2 mm. long, distinct, linear-subulate, mostly with one or two

linear lobes near the base, glabrous or sometimes with a few cilia; cyathia solitary at the nodes or somewhat clustered at the branch-tips; peduncles up to 6.5 mm. long but mostly much shorter; involucre campanulate, 1.4–2 mm. in diam., glabrous without, densely pubescent above inside; lobes slightly exceeding the glands, triangular, acuminate, entire or the distal with one or two erect teeth on the sides and the proximal sometimes many-toothed; glands circular or nearly so but often folded together, 0.5 mm. in diam.; appendages conspicuous, white, often rubescent, obovate to elliptic to elliptic-oblong (radially) 1–2.8 mm. long, glabrous; 5th gland filiform, ca. ⅔ as long as to nearly equaling the lobes; sinus U-shaped, slightly depressed; bracteoles forming a radial partition opposite the glands, adnate to the involucre for about half its length, united to the gynophore at the very base, upper half of 3–6 filiform ciliate segments equaling the androphores; staminate flowers 9–12 per fascicle, 37–58 per cyathium; androphores 1.9–3 mm. long, glabrous, included; gynophore glabrous, soon exserted and reflexed; ovary glabrous, roundly 3-lobed; styles bifid ½–¾ distance to the base, 1–1.3 mm. long; capsule glabrous, oblate-spheroidal and nearly symmetrical, rounded-triangular in horizontal cross section, ca. 2.5 mm. long; seeds subtetragonal, lateral and dorsal angles slightly winged, ventral angle very low, 1.7–2 mm. long, 1.3–1.6 mm. radially, 1.4–1.7 mm. tangentially, radially broadly ovate, base truncate, facets smooth except for two (rarely three on dorsal facets) low transverse ridges which do not pass through the angles, occasionally the ridges irregular; white cellularly microreticulate coat mostly thick enough to make the seeds a dull white to sordid.—Plate 667C.

Southern Arizona, south to Sinaloa (Map 17). Representative specimens seen: Arizona. Yavapai Co.: Fort Whipple, Rio Verde, *Coues & Palmer 531* (M). Gila Co.: Rock Creek, *Collom 314* (M, US). Graham Co.: Camp Grant, *Ed. Palmer 237* (M). Pima Co.: near Baboquivari Canyon, *Peebles, Harrison & Kearney 2773* (M, US); foothills of Santa Catalina Mountains, July 30, 1881, *C. G. Pringle* (M, US); Baboquivari Mountains, *M. E. Jones 24862* (G, NY); Santa Rita Forest Reserve, *Griffiths & Thornber 8* (NY, US); small range reserve near Tucson, *Griffiths 6172* (US); common on range reserve, Wilmot, *Thornber 136* (M). Cochise Co.: San Bernardino Ranch, Mex. Boundary line, *Mearns 611* (US); Rucker Valley, *Lemmon 469* (G); Bowie, *M. E. Jones 4263* (I, NY, US). MEXICO. Sonora: arroyo, Los Conejos, Rio Mayo, *Gentry 1119* (G, W); La Cruz de las Cañadas, *Lloyd 463* (G); high mountains, Guaymas, Sept., 1887, *Palmer 209* (G, US); Alamos, *Palmer 640* (G, US); San Bernardo, Rio Mayo, *Gentry 1148* (Sh); 5 miles east of Garumbullo, *Wiggins 6124* (US). Sinaloa: Cofradia, vicinity of Culiacan, Oct. 21, 1904, *T. S. Brandegee* (G).

11. Euphorbia trachysperma Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 189. 1859. Type: low damp soil near the San Pedro River, Cochise County, Arizona, Sept. 9, 1851, *Wright 1832* (M 200493!; photograph G!, W!; isotypes G!, NY!). —*Chamaesyce trachysperma* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 412. 1916.

Erect glabrous annual 15–40 cm. tall; stems mostly branching from the base, 0.7–3 mm. thick, internodes up to 6 cm. long; blades linear, lanceolate, ovate-lanceolate and obtuse, to oblong, 1–4 cm. long, margin serrulate at least at the apex; petioles 1–2 mm. long; stipules distinct, 1–1.4 mm. long, bearing a few cilia or glabrous, mostly divided above into 3 segments, the middle greatly exceeding the two lateral; cyathia solitary at the nodes; peduncles up to 5 mm. long but mostly shorter; involucres campanulate, 1.7–2.1 mm. in diam., 3–3.5 mm. long, glabrous outside, shortly hairy on upper half inside; lobes broadly triangular, acuminate, slightly to markedly exceeding the glands; glands transversely oval to subcircular, more or less folded, 0.5–0.7 mm. long; appendages white, about half as wide as to a little wider than the glands, entire; fifth gland filiform, ca. ⅔ as long as lobes; sinus broadly V-shaped, not depressed, with a tuft of hair in the fundus; bracteoles forming a radial partition adnate to the lower half of the involucre and completely surrounding the inner side of the fascicles at the base, parted above into 3 or 4 linear, shortly hairy segments about equaling the androphores; staminate flowers 10–13 per fascicle, 54–63 per cyathium; androphores glabrous, 2–2.8 mm. long; gynophore glabrous or rarely with a few hairs, soon exserted and reflexed; ovary glabrous, roundly 3-lobed; styles 0.7–1 mm. long, bifid to the middle; capsule glabrous, 3.1–3.3 mm. long, very short-cylindric but slightly narrower above, sharply 3-angled, base truncate, apex obtuse; seeds grayish-brown, quadrangular, dorsal and lateral angles sharp, ovate to narrowly ovate radially, base truncate, apex acute, 2–2.3 mm. long, tangentially 1.3–1.7 mm., radially 1.3–1.6 mm., ventral facets plane or slightly concave, dorsal facets convex, surface of seed slightly rough with scattered irregular pits, angles irregularly notched, or ventral facets with two or three faint transverse grooves.—Plate 667D.

Southern Arizona, south to Sonora (Map 21). Representative specimens seen: Arizona. Yuma Co.: west of La Paz, 1869, *Ed. Palmer 20* (US). Pima Co.: Tucson, 1867, *Dr. Smart* (US). Pinal Co.: Maricopa, *Thornber 9141* (T). MEXICO. Sonora: high mesas, Guaymas, Sept., 1887, *Ed. Palmer 183* (G, US); in an enclosure, Guaymas, Oct., 1887, *Ed. Palmer 319* (G, US); Ciudad Obregon, *Gentry 266* (G).

12. Euphorbia hyssopifolia L., Syst. Nat. ed. 10, **2:** 1048. 1759. Type: Probably from Jamaica, *Patrick Browne* (Linnaean

Herb., not seen; photograph G!; rephotograph W!). The narrow-leaved extreme. Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 432. 1917.—*Anisophyllum hyssopifolium* (L.) Haw., Syn. Pl. Succ., 161. 1812; Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 35. 1860.—*E. hypericifolia* L. "β *hyssopifolia,* L.", Griseb., Fl. Brit. W. I. Is., 54. 1859; published as quoted.—*E. brasiliensis* Lamarck var. *hyssopifolia* (L.) Boiss. in DC. Prod. **15** (**2**)**:** 24. 1862.—*Chamaesyce hyssopifolia* (L.) Small, Journ. N. Y. Bot. Gard. **3:** 429. 1905.

E. brasiliensis Lamarck *sensu* Boiss. in DC. Prod. **15** (**2**)**:** 24. 1862 and most subsequent authors.—*Chamaesyce brasiliensis* (Lamarck) Small, Fl. Se. U. S., 712, 1333. 1903, *sensu* Small, l. c., and subsequent publications in part.

E. Jonesii Millsp., Pittonia **2:** 89. 1890. Type: Bowie, Cochise County, Arizona, Sept. 17, 1884, *M. E. Jones 4247* (F 196592!; photographs G!, W!; isotypes O!, US!). The large-seeded western facies of the species.—*Chamaesyce Jonesii* (Millsp.) Millsp., Field Mus. Pub. Bot. **2:** 410. 1916.

E. stenomeres Blake, Contr. U. S. Nat. Herb. **24:** 13. 1922. Type: Open hillsides wooded with pine, trail from Los Amates to Izabal, Department of Izabal, Guatemala, May 31, 1919, *S. F. Blake 7776* (US 989628!, photograph G!, W!). Appears to be a good match for the type of *E. hyssopifolia* L.

Annual or sometimes perhaps overwintering; stems mostly erect, mostly glabrous, sometimes sparsely pilose in Arizonan plants, simple below or sometimes branched from the base, 8–60 cm. tall, mostly 1–3 mm. thick, internodes mostly 1–3 cm. long, rarely up to 6; leaves 5–30 mm. long, lanceolate and often falcate to oblong, all leaves often small in over-wintering plants, mostly glabrous, sometimes sparsely pilose especially toward the base, base inequilateral, margin usually serrate; petioles 1–1.5 mm. long; stipules mostly united, for the most part triangular and as broad as high with slightly lacerate and occasionally ciliate margin, toward the branch-tips sometimes partly distinct, narrowly triangular, up to ca. 1 mm. long, with erect linear teeth; cyathia solitary in the upper bifurcations and in few-flowered leafy cymes; peduncles 0.5–2 mm. long, glabrous; involucres obconical to obconic-campanulate, tapering to the peduncle, 0.7–0.9 mm. in diam., glabrous outside, glabrous inside except at the base of the lobes and on the stipes; lobes triangular, attenuate, slightly exceeding the glands, distal mostly entire, proximal often with erect linear teeth; glands circular to broadly elliptical transversely, 0.15–0.3 mm. long; appendages white or sometimes reddish in age, glabrous, entire, ⅓ as wide as to twice as wide as the gland, semilunate; fifth gland linear, ca. ½ as long as the lobes; sinus U-shaped, slightly depressed; bracteoles forming a very narrow radial partition adnate to the involucre below

each gland, free portion parted into few linear subglabrous segments; staminate flowers 4–15 per cyathium; androphores glabrous, 0.9–1.3 mm. long; gynophore glabrous, well-exserted and usually reflexed; ovary glabrous, strongly 3-lobed; styles glabrous, 0.5–0.9 mm. long, bifid ½–⅔ to base; capsule glabrous, broadly ovoid, wider below the equator, 1.6–2.1 mm. long, strongly and subacutely 3-lobed; seeds ovoid-subquadrangular, 1–1.4 mm. long, 0.7–1.1 mm. tangentially and radially, radially ovate to elliptical-ovate, ventral facets slightly concave to slightly convex, dorsal facets convex, both with very shallow depression from half as wide as to as wide as the facet, separated by very low smooth ridges, chocolate-brown to grayish-white.—Plate 656D.

South Carolina, Florida, Louisiana, western Texas, southern New Mexico, and Arizona; generally distributed south to temperate South America (Map 38). Representative specimens from the United States: South Carolina. Colleton Co.: 3 miles south of Walterboro, *Wiegand & Manning 1817* (G). Florida. Alachua Co.: campus, Gainesville, *O'Neill 458* (US). Lake Co.: near Eustis, *Nash 930* (G, M, NY, US). Orange Co.: Orlando, *Curtiss 6670* (G, M, US). Dade Co.: Miami, *Demaree 10214* (M, US); Arch Creek Prairie, *J. K. Small, Mosier & G. K. Small 6800* (NY, US); Buena Vista, *Moldenke 328* (M, NY, US). Lee Co.: Myers, *A. S. Hitchcock 324* (G, M, NY, US); near Punta Rassa, *J. P. Standley 307* (G, M, US); near Fort Myers, *P. C. Standley 12656* (US). Manatee Co.: Manatee, *Webber 26* (M). Hillsborough Co.: *Fredholm 6280* (G, US). Pinellas Co.: St. Petersburg along beach, *Tidestrom 7028* (US); near St. Petersburg, *Deam 2758* (G, M). Franklin Co.: cultivated at Apalachicola, *Biltmore Herb. 3844*[a] (G, M, NY, US). Louisiana. Plaquemines Co.: Port Eads, *Lloyd & Tracy 213* (NY). Texas. Jeff Davis Co.: Fort Davis, Davis Mountains, *Ferris & Duncan 2698* (M, NY). Brewster Co.: Alpine, *Hughes 22* (NY); Oak Canyon, Chisos Mountains, *Cory 7005* (G); Lower Green Gulch, Chisos Mountains, *Sperry 450* (US); Sunny Glenn, *Sperry T244* (US). New Mexico. Doña Ana Co.: Organ Mountains, *Wooton 609* (M, NY, US); east side Organ Mountains, Aug. 17, 1895, *Wooton* (NY, US); Van Pattens, Organ Mountains, Sept. 10, 1899, *Wooton* (NY, US). Luna Co.: Cedar Springs, Florida Mountains, *Mulford 1037a* (M, NY). Arizona. Yavapai Co.: Camp Lincoln, 1869, *Ed. Palmer* (US). Maricopa Co.: Mesa, *Peebles, Harrison & Kearney 224* (US). Gila Co.: Sierra Ancha, *Harrison & Kearney 5682* (A, US). Graham Co.: near Safford, *Maguire, Richards & Moeller 16018* (G, I). Pima Co.: Tucson, May 1, 1894, *Toumey* (NY, US); Santa Cruz Valley near Tucson, June 20, 1881, *Pringle* (G, M, NY, US); Baboquivari Mountains, *M. E. Jones 24859* (G, NY); Santa Catalina Mountains, *Harrison*

& Kearney 8045 (US). Santa Cruz Co.: Nogales, *Peebles, Harrison & Kearney 4590* (US); Nogales, *Peebles & Harrison 4692* (US). Cochise Co.: near Fort Huachuca, *Wilcox 320* (US); Portal, Chiricahua Mountains, *Eggleston 10725* (US); Fort Lowell, *Thornber 209* (M, NY).

E. brasiliensis Lamarck, Encyc. Meth. Bot. **2:** 423. 1786, has generally been considered as conspecific with *E. hyssopifolia* L. However, the ovary and capsule of *E. hyssopifolia* and what has been known as *E. brasiliensis* are noted for being quite glabrous. Examination of two fragments of *E. brasiliensis* at F, one supposedly from the type, collected by *Commerson* in Brazil, and the other from an isotype both at Herb. Mus. Paris, shows that Lamarck did not err when he wrote "L'ovaire est chargé de poils blancs." The hairs are mainly on the backs of the carpels and seem to be at least partially deciduous. The rather young seeds do appear to be identical with those of *E. hyssopifolia.* The type collection of *E. brasiliensis* may represent merely a trivial variant of *E. hyssopifolia* but whatever the entity, it does not occur in the United States or Canada.

The plants of Texas, New Mexico, and Arizona are generally larger-seeded than those of South Carolina, Florida, and Louisiana. The western plants also tend to be slightly vestite. The absence of the species in southern Texas and its presence in western Texas further suggest that there are two distinct races involved. However, since the differences are so trifling when many specimens are examined and Mexican specimens seem to be intermediate, it seems futile to try to separate as named categories the northern tips of two lines of northward migration of a widespread and variable tropical species. Examination of the total variation of the species is necessary before a proper evaluation of any of its facies can be made.

13. Euphorbia maculata L., Sp. Pl. **1:** 455. 1753. Type: "*America septentrionalis*" (Linnaean Herb., not seen; photograph G!; rephotograph W!). A good representative of the species as here interpreted. Linnaeus, Mantissa Altera, 392. 1771; Elliott, Sketch Bot. So.-Car. & Georgia **2:** 654. 1824, and probably other early writers.—*E. hypericifolia* L. β. *E. maculata* (L.) Lam., Encyc. Meth. Bot. **2:** 422. 1786.—*Tithymalus maculatus* (L.) Moench. Meth. Pl., 666. 1794.—*Anisophyllum maculatum* (L.) Haw., Syn. Pl. Succ., 162. 1812.—*E. hypericifolia* L. var. *maculata* (L.) Raf., Med. Fl. U. S. **1:** 183. 1828 (basinym

given above in synonymy, and the plant described belongs here). *Xamesike maculata* Raf., Aut. Bot., 97. 1840, basinym indicated only as "Euph. d[itt]o. O.[mnes]."—*E. trinervis* Bertoloni, Fl. It. **5:** 37. 1842, a renaming of "E. maculata *Mant. alt. p.* 392" under the misapprehension that Linnaeus' use there was a misapplication.—*Chamaesyce maculata* (L.) Small, Fl. Se. U. S., 713, 1333. 1903.

E. nutans Lag., Gen. et Sp. Pl., 17. 1816. Type: "Habit.[at] in N.[ova] H.[ispania]" (Perhaps at Madrid judging by Alph. DC., Phytographie, 426. 1880). See discussion after citation of specimens.—*Chamaesyce nutans* (Lag.) Small, Fl. Se. U. S. 712, 1333. 1903.

E. Preslii Guss., Fl. Sic. Prod. **1:** 539. 1827. Type: Palermo, Italia, *Todaro* (Praha?; fragment F!). May be only isotype material at best but marked in Millspaugh's hand "From the type material Herb. Praag.". The specimen belongs in this entity. Boiss. in DC. Prod. **15 (2):** 23. 1862.—*Chamaesyce Preslii* (Guss.) Arthur, Torreya **11:** 260. 1912.

E. hypericifolia L. var. *communis* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2 (1):** 188. 1859. Type: New Mexico, 1851–2, *C. Wright 1842* (M?, not found; isotypes NY!, US!). Engelm. in Chapman, Fl. So. U. S., 403. 1865. *Wright 1842* was a mixture of two species (see under 16a) and the locality printed on the labels of these collections is general and often *erroneous*.

Chamaesyce Lansingii Millsp., Field Mus. Pub. Bot. **2:** 376. 1913. Type: paved ditches, 56th Street, Chicago, Cook County, Illinois, Aug. 6, 1898, *O. E. Lansing Jr. 402* (F 196688!).

"**E.** (bezw. **Chamaesyce**) [*nutans* var.?] **pseudonutans**", Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 431. 1917. See discussion of this after citation of specimens. "**E.**" stands for *Euphorbia.*

E. hypericifolia L. *sensu* American authors in large part.

Many extralimital synonyms listed by Boissier in DC. Prod. **15 (2):** 23. 1862, and Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 426–432. 1917, are omitted here since no authentic material has been available.

Annual; stems mostly erect, mostly simple below, 8–80 cm. tall (or taller according to collector's notes), 1–4 mm. thick, internodes mostly 1–4 cm. long, crisply pubescent at least on a line and on the young tips, then becoming glabrous; leaves oblong-lanceolate to oblong or even occasionally falcate-lanceolate, 8–35 mm. long, mostly glabrous above, sometimes sparsely long-pilose, usually long-pilose beneath especially toward the base, base inequilateral, margin serrate; petioles 1–1.5 mm. long; stipules mostly united, mostly broadly triangular-acuminate, up to ca. 1 mm. long, margin ciliate, slightly toothed, uppermost often nearly distinct, narrowly triangular, margin

with erect linear teeth; cyathia both solitary at the nodes and clustered in cymes; peduncles 0.5–5 mm. long, glabrous; involucres glabrous outside, sparsely pubescent inside on the bases of the lobes and stipes, obconical to obconical-campanulate, tapering to the peduncle, 0.7–1 mm. in diam.; lobes triangular, slightly exceeding the glands, the distal mostly entire, the proximal often with erect linear teeth; glands long-stipitate, circular to broadly transversely elliptical, 0.1–0.3 mm. in diam.; appendages rudimentary to 0.5 mm. long, oval, white to reddish, glabrous, entire or bluntly lobed; fifth gland linear, ca. ⅔ as long as lobes; sinus U-shaped, slightly depressed; bracteoles forming a slender segment below each gland, united to the involucre below, entire or with two to four filiform glabrous or sparsely hairy divisions above; staminate flowers 5–11 per cyathium; androphores glabrous, 1–1.1 mm. long; gynophore glabrous, well-exserted and usually reflexed; ovary glabrous, roundly 3-angled; styles ⅓–½ bifid, 0.6–1 mm. long; capsule glabrous, broadly ovoid, wider below the equator, 1.9–2.3 mm. long, strongly and subacutely 3-lobed; seeds ovoid-subquadrangular 1.1–1.6 mm. long, 0.9–1.1 mm. tangentially and radially, elliptic-ovoid radially, facets convex, with a finely rippled surface, coat dark grayish, brown or sometimes pale gray.—Plates 656B and 668B.

Ontario; all states east of the Mississippi River except Maine; Minnesota and South Dakota south to northern Florida and Texas; introduced in California and Washington; southward to South America; and introduced in the Old World (Map 10). Representative specimens seen from the United States and Canada: New Hampshire. Belknap Co.: Meredith, Aug., 1894, *Carter* (NE). Strafford Co.: near Dover, *Hodgdon 677* (NE). Hillsborough Co.: Milford, Sept. 5, 1902, *J. A. Wheeler* (NE). Vermont. Rutland Co.: Brandon, Sept. 11, 1909, *Dutton* (M); Wallingford, Aug. 3, 1907, *Kennedy* (G). Massachusetts. Middlesex Co.: Concord, Sept., 1857, *Hoar* (NE); Somerville, Aug. 31, 1899, *Flynn* (NE). Hampshire Co.: South Hadley, 1887, *Cook* (US). Berkshire Co.: Pittsfield, Sept. 23, 1899, *Hoffmann* (NE). Connecticut. Hartford Co.: Southington, *Bissell 529* (NE). Litchfield Co.: North Canaan, Aug. 17, 1910, *Woodward* (NE). Middlesex Co.: Middletown, *Blewitt 850* (NE). New Haven Co.: Oxford, Sept. 28, 1916, *Harger* (Ph). Fairfield Co.: Fairfield, Aug. 11, 1893, *Eames* (Ph). New York. Orange Co.: Newburgh, Sept. 8, 1895, *Pollard* (US). Westchester Co.: Worthington, *Pennell 8282* (Ph). Warren Co.: Lake George, 1882, *Vasey* (US). Tompkins Co.: Ithaca, July 20, 1893, *Wiegand* (US). Dutchess Co.: near Clove, *Standley & Bollman 12243* (US). New York Co.: Bronx Park, Sept. 3, 1896, *Nash* (Ph). Suffolk Co.: Wading River, *Miller 119* (US). New Jersey. Middlesex Co.: Stelton, *Mackenzie 2857* (M, US).

Somerset Co.: Peapack, *Perry* (M). Hunterdon Co.: Stockton, on Delaware River, *Benner 7008* (PhB). Ocean Co.: near Bay Head, Sept. 21, 1914, *Lighthipe* (M). Camden Co.: Oaklyn, Sept. 22, 1922, *Bassett* (PhB). Burlington Co.: north of Birmingham, *Long 19622* (PhB). Gloucester Co.: Sewell, *Long 17121* (PhB). Salem Co.: Centerton, *Long 32522* (PhB). Atlantic Co.: northwest of Bakersville, *Long 15194* (PhB). Cumberland Co.: south of Millville, *Fogg 5934* (PhB). Cape May Co.: Cape May City, Aug. 26, 1918, *Stone* (PhB). Pennsylvania. Luzerne Co.: above Nescopec on Susquehanna River, *Heller 14207* (M). Northampton Co.: Easton, Sept. 19, 1895, *Porter* (US). Lehigh Co.: south of Walbert's station, *Pretz 11116* (PhB). Allegheny Co.: Sharpsburg, Aug. 31, 1902, *Hatry* (Ph). Lebanon Co.: South Mountain, *Heller 668* (US). Lancaster Co.: Lancaster, Sept. 26, 1901, *Heller* (US). Philadelphia Co.: Gibson's Point, *McElwee 691* (Ph). Chester Co.: West Chester, Aug. 31, 1844, *Darlington* (M). Delaware. Queen Anne's Co.: Centreville, Aug. 14, 1868, *Commons* (Ph). Maryland. Montgomery Co.: above Cabin John, *Painter 1027* (M). Prince Georges Co.: Laurel, Sept. 12, 1897, *Knowlton* (US). Calvert Co.: Chesapeake Beach, *House 1451* (US). Wicomico Co.: Salisbury, *Tidestrom 7460* (US). Worcester Co.: Snow Hill, *Moldenke 6632* (NY). District of Columbia. Washington, Rock Creek, near west gate of zoo, *Pollard 648* (US). West Virginia. Ritchie Co.: Laurel Junction, Sept. 12, 1879, *Smith* (US). Upshur Co.: near Buckhannon, July 29, 1895, *Pollock* (US). Virginia. Page Co.: near Luray in the Blue Ridge, *Steele 37* (US). Alexandria Co.: Glencarlyn, *Dewey 40* (US). Fairfax Co.: Clifton, Oct. 10, 1884, *Ward* (US). James City Co.: Williamsburg, *Grimes 4433* (NY). Campbell Co.: near Lynchburg, Aug. 24, 1900, *U. C. Smith* (Ph). Amherst Co.: Monroe, Aug. 16, 1899, *Pieters* (US). Montgomery Co.: Allegheny Springs, Aug. 10, 1898, *Mohr* (US). Princess Anne Co.: near Virginia Beach, *Kearney 2108* (US). Greensville Co.: Emporia, *Tidestrom 6902* (US). North Carolina. Durham Co.: Durham, Aug. 18, 1931, *Blomquist* (Ph). Iredell Co.: Statesville, *Hyams* (US). Swain Co.: Swayney, Sept. 10, 1913, *Mooney* (US). Buncombe Co.: Biltmore, *Biltmore Herb. 403[b]* (NY). Haywood Co.: Lake Junaluska, *Oosting 34403* (Ph). Cherokee Co.: Andrews, Sept., 1900, *Huger* (NY). South Carolina. Pickens Co.: Clemson College, *House 2885* (US). Oconee Co.: *Anderson 1537* (US). Charleston Co.: Santee Canal, Sept., ?, *Ravenel* (M). Georgia. De Kalb Co.: Stone Mountain, *Pennell 4042* (NY). Richmond Co.: Augusta, Oct. 2, 1898, *Cuthbert* (NY). Florida. Citrus Co.: June–July, 1898, *A. S. Hitchcock* (M). Brevard Co.: Okeechobee region, *Fredholm 6014* (NY). Leon Co.: Tallahassee, *Nash 2519* (NY, US). Ontario. Kent Co.: Chatham, *Macoun 5898* and *24716* (NY).

Michigan. Saint Clair Co.: Port Huron, *Dodge 7* (US). Ingham Co.: East Lansing, Aug. 19, 1891, *C. F. Wheeler* (US). Van Buren Co.: South Haven, *Lansing 3339* (US). Washtenaw Co.: 3 miles northwest of Ann Arbor, *Hermann 9073* (NY). Wayne Co.: River Rouge south of Detroit, Aug. 17, 1916, *Chandler* (US). Ohio. Lorain Co.: Oberlin, Aug. 17, 1894, *Ricksecker* (US). Cuyahoga Co.: Berea, June, 1897, *Ashcroft* (US). Holmes Co.: Salt Creek Township, *Drushel 9470* (US). Shelby Co.: Sept., 1904, *Clevenger* (US). Miami Co.: Fletcher, Aug. 20, 1897, *Clevenger* (US). Franklin Co.: Columbus, Oct. 24, 1898, *Clevenger* (US). Pickaway Co.: Circleville, Aug. 25, 1926, *Dreisbach* (Ph). Greene Co.: Jamestown, Sept., 1896, *Wooton* (US). Hamilton Co.: Cincinnati, Aug., ?, *Lea* (Ph). Scioto Co.: Friendship, *Demaree 10809* (US). Indiana. Marshall Co.: Lake Maxinkuckee, *Evermann 1021* (US). Lake Co.: Gary, *Lansing 4028* (Ph). Hamilton Co.: Mattsville, *Wilson 27* (US). Clark Co.: Clarke, *Lansing 4020* (Ph). Dubois Co.: 2 miles east of Clear Springs, *Deam 26793* (Ph). Spencer Co.: 4 miles southwest of Chrisney, *Deam 37495* (Ph). Warrick Co.: 2 miles southeast of Yankeetown, *Deam 37598* (Ph). Kentucky. Franklin Co.: Frankfort, *Biltmore Herb. 403*[d] (US). Scott Co.: Stamping Ground, *Singer 353* (US). Fayette Co.: Lexington, *McFarland 136* (Ph). Bell Co.: Aug. 15, 1888, *F. E. Lloyd* (NY). Tennessee. Carter Co.: Roan Mountain Station, *Rydberg 8223* (NY). Coffee Co.: Tullahoma, *Biltmore Herb. 403*[a] (US). Knox Co.: Knoxville, *Ruth 2498* (NY). Davidson Co.: Nashville, *Svenson 139* (G). Hamilton Co.: Chattanooga, *Lippincott 98* (Ph). Alabama. Jefferson Co.: Birmingham, *H. E. Wheeler 1207* (NY). Lee Co.: Auburn, *F. S. & E. S. Earle 36* (G, US). Hale Co.: south of Rosemary, *Harper 3246* (G, M, NY, US). Baldwin Co.: Tensaw, *Tracy 9018* (NY, US). Mobile Co.: Mobile, Sept., 1892, *Mohr* (US). Mississippi. Tunica Co.: west of Dundee, *Anderson 4479* (Ph). Warren Co.: Vicksburg, *Demaree 14104* (M). Hinds Co.: Raymond, *Holt 74* (US). Wisconsin. Saint Croix Co.: Hudson, Sept. 1896, *Moyer* (US). Illinois. Cook Co.: Chicago, *Lansing 2780* (NY). Stark Co.: Wady Petra, Aug. 21, 1894, *V. H. Chase* (Ph, US). McLean Co.: Bloomington, *Robinson* in *Pl. Exs. Gray. 229* (M, NY, Ph, US). Vermilion Co.: Catlin, *Lansing 3494* (US). Richland Co.: near Olney, *Ridgway 3260* (Ph). Minnesota. Hennepin Co.: Fort Snelling, *Mearns 549* (US). Chippewa Co.: Myers, *Moyer 2319* (Mi). Washington Co.: Lake St. Croix, Afton, Sept., 1919, *Butters* (Mi). Goodhue Co.: Red Wing, July, 1886, *Sandberg* (Mi). Scott Co.: Prior Lake, *Moyle 2084* (Mi). Wabasha Co.: Lake City, *Manning 3019* (Mi). Winona Co.: Dresbach, *Arthur 79* (Mi). Houston Co.: Crooked Creek, *W. A. Wheeler 336* (Mi). Iowa. Fayette Co.: *Fink 451* (US). Marshall Co.: LaMoille to Mar-

shalltown, Aug. 21, 1927, *Lounsberry* (Ph). Johnson Co.: Coralville, *Somes 3569* (US). Missouri. Pike Co.: Aberdeen, *Davis 955* (US). Nodaway Co.: Burlington Junction, *Singleton 213* (Mo). Clay Co.: Randolph, *Mackenzie 380* (M). Jackson Co.: Eton, *Bush 7749* (US). St. Louis Co.: Allenton, Oct. 1, 1896, *Letterman* (M, Ph). Cole Co.: Osage, Oct. 15, 1900, *Norton* (M). Jefferson Co.: Kimmswick, *Wislizenus 377* (M). Miller Co.: Bagnell, *Trelease 880* (M). St. Francois Co.: Flat River, *Trelease 878* (M). Greene Co.: Sac River, *Trelease 877* (M). Jasper Co.: Joplin, *Trelease 874* (M). Barry Co.: Roaring River, *Trelease 1178* (M). McDonald Co.: Butler Creek, Noel, *E. J. Palmer 4261* (M). Taney Co.: Forsyth, *Trelease 873* (M). Arkansas. Carroll Co.: Oakgrove, *Bush 15918* (M). Benton Co.: *Bush 15743* (M). Crittenden Co.: West Memphis, *Demaree 11097* (M). Pulaski Co.: Pulaski Heights, Little Rock, *Demaree 8239* (M, US). Garland Co.: Hot Springs, *Runyon 1495* (US). Jefferson Co.: Bayou Bartholomew, *Demaree 13972* (M). Pike Co.: Murfreesboro, *Demaree 9430* (M). Howard Co.: Mineral Springs, *Demaree 9736* (M). Hempstead Co.: Fulton, *Bush 949* (M). Nevada Co.: 4 miles southeast of Prescott, *Hollister 81* (US). Miller Co.: Texarkana, *Demaree 13470* (M). Louisiana. Ouachita Co.: Bastrop, *Demaree 14116* (NY). Natchitoches Co.: Natchitoches, *E. J. Palmer 8729* (NY, US). Rapides Co.: near Alexandria, *Ball 405* (NY, US). Calcasieu Co.: near Lake Charles, *Allison 148* (NY). Orleans Co.: New Orleans, *Tracy 7429* (US). South Dakota. Clay Co.: Vermilion, *Visher 4103* (M). Bon Homme Co.: Running Water, Sept., 1892, *Thornber* (M). Nebraska. Knox Co.: Pishelville, *Clements 2751* (US). Saunders Co.: Ashland, July, 1888, *Williams* (US). Cass Co.: Weeping Water, June, 1887, *Williams* (US). Otoe Co.: Nebraska City, Oct. 14, 1900, *Hedgcock* (M). Saline Co.: Crete, *Dreisbach 6025* (Ph). Kearney Co.: Minden, Aug., 1892, *Milligan* (US). Nuckolls Co.: Aug., 1899, *Hedgcock* (M). Kansas. Riley Co.: *Norton 473* (US, M). Osborne Co.: Osborne City, Sept. 2, 1894, *Shear* (US). Graham Co.: Bogue, *Imler 46* (M). Geary Co.: along Otter Creek, *Gates 18947* (M). Douglas Co.: Lawrence, July, ?, *W. C. Stevens* (US). Morris Co.: Dwight, Oct., 1900, *Norton* (M). Oklahoma. Kay Co.: near Ponca, *G. W. Stevens 1917½* (M, US). Grant Co.: near Lamont, *G. W. Stevens 1798* (M, US). Delaware Co.: *Bush 15733* (M). Payne Co.: Stillwater, *Waugh 381* (M). Oklahoma Co.: Oklahoma City, *Waugh 397* (US). Texas. Tarrant Co.: *Killian 6873* (US). Randall Co.: Palo Duro Canyon, *Ball 1259* (US). Denton Co.: *Graham 31* (US). Parker Co.: Weatherford, *Tracy 8119* (Ph, US). Dallas Co.: near Dallas, June–Sept., ?, *Reverchon* (M, Ph, US). Bowie Co.: Texarkana, *Heller 4190* (Ph, US). Taylor Co.: Abilene, *Tracy 7842* (G, M, Mo, NY, Ph, US). El Paso Co.: El

Paso, *M. E. Jones 4174* (I, NY, US). Jeff Davis Co.: Musquiz Creek Canyon, *Sperry T243* (US). Travis Co.: Austin, *Schulz 720* (US). Montgomery Co.: Willis, Aug., ?, *Warner* (M). Gillespie Co.: Cherry Springs, *Jermy* (M). Val Verde Co.: 48 miles south of Ozona, *Ferris & Duncan 3012* (M, NY). Kerr Co.: Kerrville, *Heller 1922* (Ph, US). Austin Co.: Industry, *Wurzlow 19* (US). Harris Co.: Houston, *Fisher 607* (US). Bexar Co.: San Antonio, *Wilkinson 56* (M). Comal Co.: Bracken, bed of Cibolo River, *Groth 208* (US). Wharton Co.: Pierce, *Tracy 7432* (US). California. Placer Co.: Dutch Flat, *MacFadden 12754* (NY, W). Tuolumne Co.: near Bear Creek, *Williamson 242* (NY). Amador Co.: Middle Fork, *Hansen 1216* (US). Butte Co.: east of Chico, *Heller 11139* (F, G, NY, Ph, US). Washington. Skamania Co.: near Hood, *Suksdorf 12327* (G, M, NY, Ph, US).

According to Thellung in a postal card of Feb. 6, 1916, filed at Gray Herbarium, Dr. E. Bonnet examined an authentic specimen of *E. nutans* in the Cosson herbarium at Paris and found it to be identical with *E. Preslii*. (How the identity of *E. Preslii* was ascertained is not explained.) Dr. Bonnet even communicated a fragment of the specimen in the Cosson herbarium to Thellung that he might judge for himself. However, Lagasca described his plant as "Caule . . . villoso" and Thellung verifies the fact and terms it "fortement poilue". Having satisfied himself that *E. nutans* and *E. Preslii* were identical and the type of *E. nutans* had villous stems, Thellung became concerned over the fact that Millspaugh had somewhere characterized *E. nutans* of the United States as glabrous. As a consequence Thellung decided that the plant of the United States differed from *E. nutans* and therefore required a new name which he proposed in the ambiguous manner quoted above near the end of the synonymy. A more confusing way of proposing a new name can hardly be imagined but is matched by "Gerbera (viridifolia var.?) Conrathii Thell., spec. vel var. nov." Vierteljahrsschrift der Naturf. Gesell. in Zurich **68:** 454. 1923. Not only is the type of the new name practically impossible to determine but the position and rank of the new name are exceedingly uncertain. Nevertheless, the problem for me is fairly simple. I am satisfied that the plants known to American authors as either *E. Preslii* or *E. nutans* are *E. maculata* L. Consequently Thellung's new name is a synonym of *E. maculata*.

There is a specimen at F which probably represents the plant which Lagasca described as *E. nutans.* It bears the data: "ex antiquo herbario generali, Herbarium Horti Botanici Matritensis, *E. Preslii, E. nutans* Lag., in hort Madrid." The stems are pilose-tomentose on the young portions and subglabrate at maturity. This agrees with the observations of Thellung. It appears that *E. nutans* was based on unusally vestite plants of *E. maculata.*

The history of the misapplication of the name *E. maculata* L. to the small-leaved prostrate plant properly known as *E. supina* Raf. has been amply reviewed in Contr. Gray Herb. **127:** 74–76. 1939. Evidence that *E. hypericifolia* L. is properly applicable to a plant ranging from the West Indies and Mexico south to South America is presented, op. cit., 73–74, and Proc. Biol. Soc. Wash. **53:** 10. 1940.

14. Euphorbia vermiculata Raf., Amer. Monthly Mag. **2** (**2**)**:** 119. 1817, op. cit., **2** (**3**)**:** 206. 1818. Type not known to exist, "Found in August, 1816, near Sandyhill and Glen's Falls, state of New York in fields." House, N. Y. State Mus. Bull. **254:** 471. 1924.—*Xamesike vermiculata* (Raf.) Raf., Aut. Bot., 97. 1840.—*Chamaesyce vermiculata* (Raf.) House, N. Y. State Mus. Bull. **233–234:** 8. 1922.[1]

E. hypericifolia L. β? *hirsuta* Torr., Comp. Fl. No. & Mid. States, 331. 1826, fully accepted in this category by Torrey, Fl. State N. Y. **2:** 176. 1843. Type: (NY?, not found). Perhaps reference to synonymy here is erroneous since Torrey, l. c., 1843, states "capsules even, sometimes pubescent." As applied here the capsules are always glabrous.—*E. hirsuta* (Torr.) Wiegand, Bot. Gaz. **24:** 50, Pl. III. 1897 (July); Robinson & Fernald, Gray's New Man. Bot. ed. 7, 546. 1908. *E. Rafinesquii* Greene, Pittonia **3:** 207. 1897 (Sept.).—*Chamaesyce Rafinesquii* (Greene) Arthur, Torreya **11:** 260. 1912 (Jan.)[2] Heller, Muhlenbergia **8:** 48. 1912 (Apr.); Small in Britton & Brown, Illus. Fl. ed. 2, **2:** 467. 1913.

Chamaesyce Rothrockii Millsp., Field Mus. Pub. Bot. **2:** 376. 1913. Type: Camp Crittenden, Santa Cruz Co., Arizona, Sept., 1874, *J. T. Rothrock 672* (F 197499!; photographs G!, W!; isotype M!). Intergrade between *E. vermiculata* and *E. maculata.*

Annual; stems prostrate to suberect, sparsely pilose, few to several from the base, 8–40 cm. long, 0.5–1.5 mm. thick, inter-

[1] Title-page date 1921, but cited by House, N. Y. State Mus. Bull. **254:** 471. 1924, as 1922 and received at Gray Herb. Feb. 24, 1922.

[2] Date of issue fide Torreya **12:** 1. 1912.

nodes up to 6 cm. long, mostly 1–2 cm. long; leaf-blades ovate to lanceolate, 5–15 or sometimes 19 cm. long, upper surface glabrous or very sparsely pilose, lower surface more or less pilose especially toward the base, margin serrulate; petioles ca. 1 mm. long; stipules distinct or united, up to 1 mm. long, ciliate or glabrous, margin fimbriate to divided into a few linear segments; cyathia solitary at the nodes or the uppermost terminal in the bifurcations of the small leafy cyme; peduncles 0.5–2 mm. long, glabrous; involucres glabrous outside, sparsely pubescent inside on the bases of the lobes and stipes, obconical to obconical-campanulate, tapering to the peduncle, 0.7–1 mm. in diam.; lobes triangular, slightly exceeding the glands, the distal mostly entire, the proximal often with erect linear teeth; glands long-stipitate, circular to broadly transversely elliptical, 0.2–0.3 mm. in diam.; appendages white, glabrous, to 0.6 mm. long, entire or bluntly toothed; fifth gland linear, ca. ⅔ as long as the lobes; sinus U-shaped, slightly depressed; bracteoles forming a slender segment below each gland, united to the involucre below, entire or with two to four filiform glabrous or sparsely hairy divisions above; staminate flowers 5–15 per cyathium; androphores glabrous, 1–1.1 mm. long; gynophore glabrous, exserted and mostly reflexed; ovary glabrous, roundly 3-angled; styles ca. ⅔ bifid, ca. 0.6 mm. long; capsule glabrous, broadly ovoid, wider below the equator, 1.6–1.9 mm. long; seeds quadrangular, 1.1–1.3 mm. long, 0.9–1 mm. tangentially, 0.7–0.9 mm. radially, radially ovate, ventral facets mostly slightly concave, dorsal facets plane to slightly convex, smoothish to slightly wrinkled, coat dark grayish brown or sometimes pale gray.—Plate 656A.

Nova Scotia, New Brunswick and Quebec to Pennsylvania and New York, west to Ontario, Michigan and Ohio; also in British Columbia, Arizona, and New Mexico (Map 41). Representative specimens seen: Nova Scotia. Hants Co.: Windsor, *Fernald, Bartram & Long 24085* (G). Digby Co.: Weymouth, *Fernald, Bissell, Graves, Long & Linder 21756* (G). Cape Breton Co.: North Sydney, *Bissell & Linder 21757* (G). New Brunswick. Victoria Co.: Aroostook Junction, Andover, *Fernald 1983* (G). Quebec. Bonaventure Co.: Matapedia, on ballast, July 10, 1904, *Collins & Fernald* (G). Megantic Co.: east of Black Lake, *Fernald & Jackson 12118* (G). Deux-Montagnes Co.: La Trappe, *Louis-Marie 198* (G). Longueuil Co.: shores of the St. Lawrence, *Marie-Victorin 1062* (G). D'Argenteuil Co.: Grenville, *Marie-Victorin & Rolland-Germain 34052* (G). Pontiac Co.: Fort-Coulonge, *Marie-Victorin, Rolland-Germain & Meilleur 43720* (G). Ontario: Kingston, Sept. 23, 1901, *Fowler* (G); Gananogue Junction, July 22, 1908, *Kennedy* (G); Minto bridge, Ottawa, *Macoun 87831* (G); Southampton, *Macoun 88079* (G). British Columbia: Englishman's River, Parksville,

July, 1915, *Carter* (G). Maine. Penobscot Co.: Bangor, *Fernald & Long 13996* (NE); Orono, Aug. 27, 1908, *Fernald* (NE). Kennebec Co.: near the Messalonskee, Oakland, Aug. 29, 1906, *Nye* (G); Winslow, *Fernald 2737* (G). Sagadahoc Co.: Topsham, *Furbish* (NE). Oxford Co.: Woodstock, 1887, *Parlin 52* (G); Bethel, 1897, *Furbish* (NE). Cumberland Co.: Portland, *Fernald, Long & Norton 13995* (NE). York Co.: York Beach, 1879, *Furbish* (NE). New Hampshire. Cheshire Co.: Hinsdale, *Raup & Weatherby* in *Pl. Exs. Gray. 565* (G, I, M, Mo, NE, NY); Hinsdale, *Robinson 578* (G, NE). Sullivan Co.: West Claremont, *Robinson 581* (G). Grafton Co.: Haverhill, *Pease 14469* (NE); Lebanon, *Kennedy 10* (G). Coös Co.: Randolph, *Pease 19128* (NE); Berlin, *A. H. Moore 44170* (G). Vermont. Franklin Co.: Maquam Bay, Hog Island, *Pease 25345* (NE). Grand Isle Co.: Lake Champlain, Aug. 15, 1885, *Morong* (NE). Chittenden Co.: Essex Junction, *Blake 2033* (NE); Burlington, *Blake 1813* (NE). Addison Co.: Shoreham, *Pease 25316* (NE). Rutland Co.: Brandon, *Pease 23971* (NE); Rutland, *Eggleston 1565* (G); Brandon, *Kennedy 9* (G). Windham Co.: Vernon, *Robinson 97* (G, NE). Bennington Co.: Dorset, *Day 376* (G, NE). Massachusetts. Middlesex Co.: West Cambridge, Sept. 4, 1896, *Harris* (NE). Suffolk Co.: South Boston, Sept. 1, 1880, *Perkins* (NE). Worcester Co.: Harvard, *Pease & Hopkins 24006* (NE). Franklin Co.: Deerfield, *Day 87* (G). Hampshire Co.: Worthington, *Robinson 616* (G); Amherst, *Seymour 2009* (NE). Hampden Co.: Springfield, Aug. 19, 1914, *Andrews* (NE). Berkshire Co.: Adams, *Day 42* (G); Sheffield, Oct. 1, 1919, *Churchill* (NE); Pittsfield, Aug. 15, 1915, *Churchill* (NE). Rhode Island. Providence Co.: Lincoln, Sept. 23, 1906, *Fernald* (G). Connecticut. Windham Co.: Killingly, Aug. 23, 1908, *Knowlton* (NE). Hartford Co.: Southington, Aug. 12, 1897, *Bissell* (G). Litchfield Co.: Canaan, Aug. 19, 1910, *Woodward* (NE). New London Co.: New London, Aug. 23, 1899, *Graves* (G). New Haven Co.: Prospect, *Blewitt 848* (NE). Fairfield Co.: Stepney, *Eames 54* (G, NE). New York. Clinton Co.: Plattsburg, beach, Sept. 16, 1917, *Hunnewell* (G). St. Lawrence Co.: Canton, *Phelps 635* (G). Washington Co.: Big Hollow, Bakers Falls, Hudson Falls, Aug. 3, 1914, *Burnham* (G). Rensselaer Co.: Tomhannock reservoir, *House 10618* (G). Albany Co.: Hudson River, Albany, Sept. 10, 1910, *Burnham* (G). Chenango Co.: Oxford, July 10, 1884, *Coville* (US). Oswego Co.: Cooperstown, *Hunnewell 6876* (G). Oneida Co.: east of Utica, *Haberer 776* (G). Cayuga Co.: North Fair Haven, Sterling, sand bar of Lake Ontario, *Whetzel 12388* (G). Tompkins Co.: Ithaca, *Wiegand 755* (G). Schuyler Co.: Montour, *Wiegand 8408* (G). New Jersey. Hunterdon Co.: southeast of Linvale, *Long 51421* (G). Ocean Co.: Lakewood, *Hunnewell 6977* (G). Pennsylvania. Lancaster Co.: between

Churchtown and Beartown on Welsh Mountains, Sept. 7, 1892, *Small* (G); Chikis quartzite, between Churchtown Road and Beartown, *Heller 670* (G, M, NY). Columbia Co.: Aristes, *Fosberg 15754* (G). MICHIGAN. Washtenaw Co.: 2.3 miles east of Ann Arbor, *Hermann 9116* (G). Shiawassee Co.: Owosso, July 30, 1890, *Hicks* (G). Saginaw Co.: Saginaw, Aug. 20, 1897, *C. F. Wheeler* (G). St. Clair Co.: near Port Huron, Aug. 28, 1896, *C. K. Dodge* (G). INDIANA. Steuben Co.: 5 miles northeast of Angola, *Deam 32533* (Deam, G). OHIO. Lake Co.: Painesville, Aug. 24, 1886, *Werner* (G). Erie Co.: Perkins, Aug. 20, 1895, *Moseley* (G). Lucas Co.: Swanton, Sept. 26, 1926, *Moseley* (G). NEW MEXICO. Grant Co.: Mangas Springs, Aug., 1901, *Metcalfe* (US); Mogollon Creek, 2 miles above falls, *Maguire, Richards & Moeller 11982B* (G). Socorro Co.: Frisco, July 25, 1900, *Wooton* (US). ARIZONA. Cochise Co.: Tanner Canyon, Huachuca Mountains, *Goodding 798* (G, NY, T, US).

After a careful consideration of Rafinesque's description, I am forced to conclude, as did House, that it applies to this entity.

The plant is probably introduced in British Columbia. In Arizona and New Mexico it may be native and represent the fringes of a puzzling Mexican complex centering around *E. maculata*. Most of the Arizonan and New Mexican plants approach or even intergrade with *E. maculata*. To identify plants of Arizona and New Mexico with those of New England when they are not found between may seem fantastic but even worse is the fact that some Argentinian specimens seem identical. In New England and vicinity the entity here recognized as *E. vermiculata* is distinct; elsewhere it is vague and seems to intergrade. A complete study must be made of *E. maculata* and its satellites in order to evaluate properly *E. vermiculata*.

A collection from Bangor, Penobscot Co., Maine, Sept. 13, 1898, *Fernald 2741* (NE) has one small plant with overlapping leaves, capsules widest at the summit, and peculiar seeds half sordid white and half dark gray. It appears to be an abnormal plant.

E. hirsuta Schur, Verh. Siebenb. Ver. Naturw. **4:** Abhang, 66. 1853, has been given as preoccupying *E. hirsuta* (Torrey) Wiegand 1897. Schur published his name as a subdivision, of unstated rank, of *E. Esula* L. The fact that he published it as a binomial does not make it capable of preoccupying an identical specific name but rather makes it invalid in the rank proposed

since binomial nomenclature is not admissible for subdivisions of species (International Rules of Botanical Nomenclature ed. 3, Art. 28. 1935). Boissier in DC. Prod. **15 (2)**:—1862, omits this name of Schur's. Unless someone can find a validation of Schur's name in specific rank prior to 1897, Wiegand's name is not preoccupied though it is a later synonym. Fernald, Rhodora **36:** 417–420. 1934, has discussed a case in which a similar name of Schur's was validated in specific rank. The listing of *E. hirsuta* Schur in Index Kewensis as a synonym of *E. Esula* obviously does not validate Schur's name.

(To be continued)

NOTES ON THE FLORA OF MINNESOTA WITH NEW RECORDS AND EXTENSIONS OF RANGES

Olga Lakela

Polygonum Douglasii Greene was discovered growing in lichen mats of a high outcrop of granite on Highway 53 about 1 mi. south of Idington, northern St. Louis County. It appears to have a local distribution. Several other granite outcrops in the region were searched for additional material without results. The species has a wide western distribution and has been reported from several states in the East. The author's collection no. 3856 is a new record for Minnesota.

Polygonum Careyi Olney, collection no. 4009, was discovered in partly cleared border of a mixed forest on Highway 23 about 4 miles northwest of Holyoke in Carlton County. The plants appeared tall and distinctive among several other species of *Polygonum* abounding in the roadside sand. This species of a wide eastern distribution is previously unreported from Minnesota.

Corallorrhiza maculata Raf. Var. flavida (Peck) Bartlett, collection no. 3585, consists of four plants wholly clear yellow with white immaculate lips of the corollas. They were growing in a colony of normally pigmented individuals of *C. maculata* on the southeast-facing slope of Hunters Hill in Duluth. To one of the plants at the time of collection a fruiting stalk of the previous

season was still attached. In a transition forest in the Duluth area typical *C. maculata* is frequent. The color form is rare and previously unreported from the state. It is known to occur in the region of Copper Harbor in Michigan and also in the state of New York.

Pyrola chlorantha Sw. Var. paucifolia Fernald was collected in dry lichen mats on granite in coniferous forest on Windigo Point at Sea Gull Lake in Cook County. Most of the plants in the colony were wholly leafless; a few with leaves less than one cm. wide. Collection no. 3614, with such notable absence of leaves, is the only collection in University of Minnesota Herbarium.

Thymus Serpyllum L., collection no. 3956, and Tunica Saxifraga (L.) Scop., collection no. 3992, are sparingly established on grassy terraces of the shore of Lake Vermilion at Vermilion Dam, northern St. Louis County. They are obviously adventives from gardens.

Carex deflexa Hornem, collection no. 3484, was discovered in moist moss of a brookside meadow at Jack Lakela's farm, Palo, St. Louis County. The earlier collections of E. P. Sheldon from Highland, Lake County, June 1893, reported as *C. deflexa*, have been correctly determined as *C. Peckii* Howe. This species extends to Cook County where it was first collected on cliffs of Clearwater Lake, June 20, 1936, by *Dr. F. K. Butters* and *Dr. E. C. Abbe.*

Allium Schoenoprasum L. Var. sibiricum (L.) Hartm. is rather abundant on ledges of Carlton slate in the gorge of St. Louis River in Jay Cooke Park, Carlton County. There are no collections in the University of Minnesota Herbarium to substantiate the early reports of the species by Warren Upham and Conway McMillan. The species is known to occur in extreme northeastern part of the state, Pigeon Point, Cook County, where *Dr. C. O. Rosendahl* and *Dr. F. K. Butters* first collected it in 1930.

Carex pauciflora Lightf. has escaped the attention of collectors in Minnesota. There are only two sheets of the material in the University of Minnesota Herbarium, collected fifty-five years ago in St. Louis and Chisago Counties. This may be due to a difficulty in recognition of the plant after the fruits have fallen.

During the summer of 1940 the author found this species in several localities including Carlton, St. Louis and Cook Counties.

Viola novae-angliae House has been previously collected in Minnesota from a single station in Jay Cooke Park, Carlton County. In St. Louis County it is one of the most common and showy violets and extends from the rocks of the north shore of Lake Superior through St. Louis River valley to the Canadian border Lakes.

Erythronium americanum Ker. has been known in the state from Winona County in the southeastern corner of the state. Conway McMillan restricted its distribution to the southern half of the state. Thompson's collections nos. 21 and 150 come from St. Louis River without specifications as to locality. In the Duluth area this species is common locally. Mr. Harold Stenbock discovered it at Adolph about ten miles north of Duluth. The author has found colonies at Fond du lac, Nopeming and in Jay Cooke Park. Collection no. 3458 was made in *Tilia-Acer* association on Arlington Avenue in Duluth where the species is abundant with *Viola rugulosa* Greene.

Madia glomerata Hook. is another western species which has become sparingly established on Duluth hills. A colony was discovered on a grassy hillside below Skyline Parkway west of Haines road. In addition to the Duluth specimens there is a collection in University of Minnesota Herbarium by *J. H. Sandberg,* Aug. 1891, from Carlton County.

State Teachers College, Duluth, Minnesota.

Cornus canadensis L., forma **rosea,** f. nov., involucri bracteis roseo-purpureis. Type: open alpine slopes (altitude 1050–1100 m.), Mt. Mattaouisse, Matane Co., Quebec, July 14, 1923, *Fernald, Griscom, Pease & Smith,* no. 25,935 (Herb. Gray).

The form with deep pink or rose-purple involucre is represented in the Gray Herbarium from Newfoundland, Quebec, New Brunswick, Maine and Alaska.—M. L. Fernald.

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ON THE USE OF THE TERMS "SUBSPECIES" AND "VARIETY"[1]

Robert T. Clausen

Words are the means by which man expresses his ideas. In the development of a large vocabulary, the human species far surpasses all other members of the animal kingdom. This vocabulary is not a static thing. Instead, it is an ever changing affair. New ideas, new discoveries, new inventions, new thoughts:—these all require either new words or redefinitions of the old. Likewise, other words, no longer necessary, drop out of usage and become obsolete. The study of these word-changes affords a fascinating field of investigation for the philologist.

To express their precise ideas, scientists have had to choose between inventing new terms or redefining in a particular fashion old and familiar words. The terms "subspecies" and "variety" both have different shades of meaning. "Subspecies," being a scientific term, is unfamiliar in our language except among biologists. As might be expected, since "subspecies" is not a popular term, it has undergone a less varied usage than has the word "variety". Persoon seems to have introduced "subspecies" in his Synopsis Plantarum in 1805. The literature since then demonstrates the conservative usage of the term. Yet Fernald, who is the most recent and active exponent of the term variety to the exclusion of the term subspecies, in 1936, stated that "the term subspecies is used in so many ways as to be vague." Also, he stated that the term variety, "as used by such discriminating recent taxonomists as the late C. E. Moss, the late Otto Holmberg

[1] Printed at the author's expense to insure immediate publication.

and countless others of the past (Linnaeus, Willdenow, DeCandolle, Kunth, Schlectendal, Hooker, Torrey, Gray and scores of others), is reasonably clear," but in that same publication Fernald found it necessary to set matters right by reducing to the grade of *formae* varieties of Linnaeus, Torrey and Gray, Nuttall, Lange and Pursh. Further, this reduction of *varietas* to *forma* has been going on through the years to the extent that in the pages of the single journal, Rhodora, there are 166 examples of varieties changed to forms. It is interesting to note that Fernald made 91 of these changes and that 36 times he had to correct the earlier botanists whom he claims to follow. Fernald implies that he understands what Linnaeus and Gray intended to mean by variety, but in making these corrections he modifies their application of the term. The discrepancies between taxonomists in applying the term variety clearly indicate that there has not been uniformity in its use. It seems reasonable to consider that not only is variety a popular term which has been borrowed by the scientists and given a more specialized meaning, but taxonomists themselves have not been in agreement concerning how it should be defined. While it is true that biologists regard the term variety as indicating a group of less than specific rank, non-biologists use the word as synonymous with "kind" or "species," without regard for taxonomic position. This usage can not be stopped, no matter what legislation a Botanical Congress might enact.

It is questionable whether subspecific categories of different grades should be rigidly defined. According to Rehder in 1927, the botanists of Harvard University in 1904 voiced the following opinion in their proposed amendments to the Paris code: "Subspecies, varieties and forms are not sharply definable or mutually exclusive categories, it is therefore better that, although their separate rank is maintained for classificatory purposes their names should be regarded as forming a single nomenclatorial class." Today, with the steady development of an experimental method in taxonomy, these categories are much nearer definition than in 1904. Yet, it still seems desirable to permit freedom to the individual worker in his concept of categories, not only of the subspecies, but also of the specific category which is today much more capable of objective interpretation than ever before.

The new taxonomy is based on the experimental approach, with its consideration not only of gross morphology, but of histology, chromosomes and chromosomal behavior, and breeding relationships. The rising group of experimental taxonomists, of whom the late H. M. Hall was a pioneer, should not now be hampered by rigid definitions made by non-experimentalists.

In 1753, in Species Plantarum, Linnaeus employed only one subspecific category, namely the variety. This term had been carefully defined in an earlier publication, "Philosophia Botanica," 1751, also still earlier elsewhere. Quoting the English translation of Ramsbottom in 1938, variety was defined by Linnaeus as "a plant changed by an accidental cause due to the climate, soil, heat, winds, etc. It is consequently reduced to its original form by a change of soil. Further, the kinds of varieties are size, abundance, crispation, colour, taste, smell. Species and genera are regarded as always the work of Nature, but varieties as more usually owing to culture." From these words, it is evident that Linnaeus defined variety for what are now regarded as modifications by experimental taxonomists, although in practice he included both modifications and trivial genetic variations. Such variations, by modern standards, are mostly random affairs of undemonstrable evolutionary importance. Yet, in Species Plantarum, Linnaeus occasionally treated as varieties groups of greater importance than modifications and trivial variations, although his usage was preponderantly in accord with his definition in "Philosophia Botanica". The majority of the 224 named varieties in edition 1 of Species Plantarum support this contention. Before citing some of these, it should be remarked that Linnaeus did not write the abbreviation "var." before his varieties. Instead he designated the epithets in different style of printing and by Greek letters. Those modern writers who, in synonymies in taxonomic works, substitute the "var." for the Greek letters are not exactly quoting Linnaeus. Returning now to examples of Linnean varieties, these include *Tanacetum vulgare β crispum*, and *Malva verticillata β crispa*, indicating crispation of the textbook-precept; *Beta vulgaris β rubra*, indicating color; *Viburnum Opulus β roseum*, for a color variation with all flowers sterile; and varieties, too numerous to mention, of the minor horticultural sort, under species like *Prunus Cerasus* with

11 such, *P. domestica* with 14 such, *Pyrus Malus* with 6 such, and *Brassica oleracea* with 11 such.

Noting that Linnaeus occasionally designated some more important entities as varieties, for example *Circaea lutetiana β canadensis*, Fernald (1940) has claimed that in actual practice Linnaeus "generally designated as varieties indigenous plants which he considered to be natural (often geographic) variations within the broad limits of his specific concept." From this assertion, Fernald passed by easy stages to the apparent conclusion that varieties are plants with strong geographic isolation. Careful study of the 224 named varieties in Species Plantarum reveals that most Linnean varieties are no such thing, but are minor variations in color, leaf-cutting, crispation, pubescence, habit, and similar characters. An occasional one is geographically significant.

After Linnaeus, writers continued to employ the one category below the specific level until Persoon in 1805 introduced the term "subspecies" into the literature. In the introduction to his Synopsis Plantarum occurs the phrase, "varietates praecipue et subspecies non omissae sunt." Persoon's usage is poorly explained, but from the content of his work there is probable indication that the subspecies are designated by Greek letters, while the varieties follow after the specific diagnoses without special prefix. The two categories beneath the species seem only weakly differentiated by Persoon, subspecies being used for the major morphological variations and varieties for the minor ones. Persoon's publication is of significance because it seems to be the starting point for the term "subspecies." Also, it should be noted that "subspecies" was the next term after "variety" to be introduced into botanical literature for subspecific units and it was used from the first for a variation of greater value than variety. The term *forma* did not appear until later.

In 1864, Alphonse DeCandolle, in his Prodromus, made the combination *Quercus robur* subsp. *pedunculata α vulgaris*. Here the higher category was clearly designated as subspecies, while the epithet prefixed by the Greek letter was the variety. Some might argue that DeCandolle's subspecies were merely supervarieties intercalated between the species and variety, but statements from the "Laws of botanical nomenclature adopted by the

International Botanical Congress held at Paris in August, 1867," do not support this opinion. Instead, subspecies were defined as the most important variations of the species. Article 14, translated into English by H. A. Weddell, states that "Modifications of cultivated species should, where possible, be classed under the wild or spontaneous species from which they are derived. For this purpose the most striking are treated as subspecies, and when constant from seed they are called races (*proles*). Modifications of a secondary order take the name of varieties, and if there be no doubt as to their almost constant heredity by seed they are termed subraces (*subproles*)." Further, DeCandolle, in the commentary of the rules, wrote "When a modification of a species is habitually hereditary, it becomes properly speaking a *subspecies,* in other words, there may be hesitation as to whether it ought not to be called a species, and many would call it so. If its characters be less striking, and transmission by seed less frequent, every one would then call it a *variety.*" Since Fernald included Alphonse DeCandolle in the army of "outstanding scholars, who correctly used the honorable old term *varietas,*" whom he claims to follow, it is interesting to note that DeCandolle does not define a variety as a unit with strong morphological and geographic differences. It is true that some of DeCandolle's varieties do exhibit strong morphological and geographic differences, but it is also true that many of them are modifications of slight importance. Some of DeCandolle's varieties of the latter type have been reduced from varietal status to *formae* by Fernald. The conclusion is that in 1867, whether or not the suggestions of the rules were carefully followed, the subspecies was designated as the most important category under the species. Further, in the list of subspecific categories enumerated in Art. 10, *forma* was still not enough in general usage to be mentioned, while variety was defined in Art. 14 in a way similar to the present day concept of *forma.*

After 1867, many European workers began to employ subspecies for the most important variations under the species. The emphasis, to be sure, was on the morphology. The series of specimens in herbaria were seldom large enough to make possible a satisfactory understanding of geographical distribution. Only now are the great collections beginning to be adequate on this

basis, and for many groups and regions, the available specimens are doubtless still scant indication of the true state of affairs in nature. Under these circumstances, it was scarcely possible for the older workers to have a geographical concept for subspecies, variety, or any other category. Furthermore, only in the present century has the geographical method come into its own in taxonomy. For an interesting example of the growth of this method, illustrating the trend of things later in the century, see Wettstein's "Grundzüge der geographisch-morphologischen Methode der Pflanzensystematik," 1898.

In America, Asa Gray was one of the great leaders in botanical thought in the last century. In 1836, he wrote "Any considerable change in the ordinary state or appearance of a species is termed a *variety*. These arise for the most part from two causes, viz.: the influence of external circumstances, and the crossing of races." The wording of this definition changed somewhat in later works by Gray, but the same idea seems to pervade all his writings on the subject. This idea might be paraphrased as a variation from a type. The geographical criterion for variety was not cited by Dr. Gray, although some of his varieties, probably coincidentally, were geographically isolated. Gray disposed of the term subspecies by defining it as "a marked variety."

The successors of Dr. Gray at Harvard University seem to have followed him in their concept of variety. Even Fernald, in his early papers seems to have thus interpreted the category, for several of his varieties, made at that time, do not conform to his later concept of the term and have now been reduced to the grade of *forma*. Examples are *Juncus macer* var. *Williamsii* reduced to a *forma* by Hermann in 1938, and *Scirpus atrocinctus* var. *brachypodus* and *S. cyperinus* var. *condensatus* reduced to *formae* by Blake in 1913. Although these were good varieties by the standards of the earlier botanists, 101 of whom Fernald has listed in his paper in the July, 1940, issue of Rhodora, such varieties are now treated as *formae* by Fernald and his followers, while a modification of the concept of subspecies, as understood by DeCandolle and others, has been substituted for the Linnaean definition of variety.

One of the greatest influences in American plant taxonomy

in the early part of this century was the "American Code of Botanical Nomenclature" (1907). This code clearly preferred the use of subspecies for variations, lower than the species, which required nomenclatorial recognition. On the use of variety, the wording of the Note under Canon 4 is remarkably clear: "The term variety is relegated to horticultural usage."

In 1926, Hall presented a pioneer paper explaining the new experimental approach in taxonomy. He favored the term subspecies for the primary divisions of species and clearly indicated the confusion in the use of the term variety. Regarding variety, Hall wrote "the term has such a multiplicity of uses and so often applies only to races, ecologic responses, horticultural forms, or even to abnormalities that, in the opinion of the writer, its use in serious taxonomic work were better discontinued."

The earliest use of *forma* perhaps was by Miquel, who, in 1843, on page 169 of his Systema Piperacearum, described a Forma *capensis* of *Peperomia reflexa*. *Forma* is clearly a later term than subspecies, which was not even mentioned in the "Laws of nomenclature" propounded in 1867. Accordingly, if two categories beneath the species are to be recognized, as many botanists deem necessary, variety and subspecies have historical priority, the former for the minor variations of species and the latter for the more important ones.

It is not the province of this paper to discuss in detail the merits of a style of nomenclature with a single subspecific unit as contrasted with one with several subspecific units. Nor is it proposed here to explain why those variations of species are most important which are partly genetic and partly geographic or ecologic. For full discussion of these details, see the excellent papers by Clausen, Keck, and Hiesey (1939, 1940), by Dobzhansky (1937), and by various writers in the New Systematics, edited by Julian Huxley (1940). From the experimental point of view, the biologically most important natural unit under the species is the *ecotype* which can be determined only by experiment. To determine populations to be ecotypes, great care should be used: details of distribution should be meticulously plotted on maps; plants should be grown in experimental gardens; and specimens ought ideally to be analyzed both cytologically and genetically. Taxonomists, by the usual observational

methods, can often detect geographic and ecologic variations which are the counterpart of the *ecotype*. Such variations are the taxonomic subspecies. Ecotypes and subspecies represent the highest category below the species level. When the experimental part of the work has not been done, the conventional taxonomic designation, subspecies, should be used alone. It is hoped that the term "subspecies" will never become as carelessly applied as has the term "variety". If that should happen, "subspecies" will have lost much of its usefulness and distinctiveness.

The experimental technique is slow and often tedious. For that reason, it will not appeal to many persons. Experimental studies in taxonomy should have the active support and cooperation of groups of biologists, each specialists in their own fields. In this way, the greatest progress can be made. To ignore the new techniques in taxonomy is not the way to progress. If there are difficulties, they must be surmounted. Science is not a static thing. To appeal to the good old days of Dr. Gray and Linnaeus is to imply such a condition. Had medical scientists followed that highly conservative policy, modern medicine might not have progressed beyond Hippocrates. Taxonomists must now be ready to accept the best information that is available from genetics, cytology, physiology, and anatomy.

If there is to be greater cooperation between workers in the various specialties of science, the barriers between zoologists and botanists must be removed. One way to achieve this is to keep the terminology as nearly similar as possible. Most vertebrate zoologists today employ the subspecies, writing the names as straight trinomials. The zoological subspecies are the largest units below the species-level which exhibit strong morphological differences and geographic distinctness. The general acceptance of subspecies by botanists for this same concept would thus represent a forward step in the direction of uniform practice. This would be a great advantage, for much ecological work is now done that considers both the plants and animals in an environment.

Critics of the subspecies say that it is a term merely substituted for variety. If these botanists see no difference between the terms, why do they in turn insist on reducing subspecies to

varieties? As a matter of fact, the terms are not synonymous and changes should not be made in either direction, as is often done, without proper corroboration of fact.

As regards the argument that the use of variety is reasonably clear, the seventh edition of Gray's Manual, edited by Robinson and Fernald, may be cited. One colleague, commenting to me in a letter, reports that he has analyzed from the standpoint of consistency an unselected series of 105 varieties in it. Of these, he states that 42 are geographical, while 63 are not. Further, he points out that this inconsistency exists within the same species, where some of the varieties are mere *modifications,* while others are the equivalent of subspecies.

Some biologists claim that the use of subspecies represents merely a state of mind, and that the argument resolves itself into a matter of terminology. They argue that taxonomy has to deal with a mixed up world in which a natural ranking of units cannot be expected. They mistake the confusion caused by a lax usage of terms on the part of many taxonomists for confusion in nature. This idea of confusion is not supported by the experimental data, which indicate that nature is orderly and that at any time in man's experience, the natural units may possess a high degree of reality. If the proper use of subspecies, with a more precise meaning than the carelessly applied and confused term "variety," will contribute toward supplying a biological basis for taxonomy, its acceptance certainly should be considered by all friends of science.

In conclusion, the principal points of this discussion may now be summarized. The Linnaean variety as defined in the "Philosophia Botanica" and as illustrated by many examples in "Species Plantarum," was a variation of a minor sort within the species. Any group, worthy of some kind of recognition, but not as a full species, was treated as a variety by Linnaeus and the majority of the botanists who followed him. Variety is the oldest subspecific unit. Those botanists who employ only one category below the species-level thus have historical usage on their side, but variety is a popular term which has had and does have many shades of meaning. Next oldest subspecific unit is the subspecies. This being a technical term, has experienced a less varied usage than variety and has been employed historically

for the most important variations under the species. Modern experimental taxonomy demonstrates that those morphological variations within the species are most important, which are correlated with geographic, ecologic, or physiological isolation. Such variations are the subspecies. Occasionally the varieties of the older botanists are coincidentally equivalent to subspecies, but more often these varieties are mere trivial genetic variations. On the other hand, some of the species of the older botanists are only subspecies, since large series today demonstrate intergradation. Those who restrict the use of variety to the major units beneath the species, which possess geographic, ecologic, or physiological isolation, are assigning a new meaning to the term. If botanists prefer in this manner to break with tradition by redefining *varietas* and thus prevent the development of a uniform style of nomenclature for both plants and animals, they should at least realize what they are doing. If, on the other hand, they wish to establish a more uniform style for subspecific groups in zoology and botany and continue the usage of many outstanding botanists, they can employ the subspecies for the major divisions of species and continue using variety in its traditional sense, as the horticulturists do.

In the preparation of this paper, there has been much help from many colleagues, to all of whom I express hearty thanks.

Bailey Hortorium,
Cornell University, Ithaca, New York.

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Rehder, Alfred. 1927. The varietal categories in botanical nomenclature and their historical development. Jour. Arn. Arb. **8:** 56–68.
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Transfers in Pyrola:—

Pyrola virens Schweigg., var. **convoluta** (Barton), comb. nov. *P. convoluta* Barton, Fl. Phil. Prodr. 50 (1815). *P. chlorantha* Sw., var. *convoluta* (Barton) Fernald in Rhodora, xxii. 52 (1920).

P. virens, var. **saximontana** (Fernald), comb. nov. *P. chlorantha*, var. *saximontana* Fernald, ibid. 51 (1920).

P. virens, forma **paucifolia** (Fernald), comb. nov. *P. chlorantha*, var. *paucifolia* Fernald in Rhodora, l. c. (1920). *P. chlorantha*, forma *paucifolia* (Fernald) Camp in Bull. Torr. Bot. Cl. lxvii. 464 (1940). *P. paucifolia* Camp (by implication incorrectly attributed to Fernald), l. c. (1940).

Pyrola virens Schweigg. in Schweigg. & Koerte, Fl. Erlang. i. 154 (1804) antedates by six years *P. chlorantha* Sw. (1810). It has been taken up by Litardière in Briquet, Fl. Corse, iii[1]. 168 (1938), by Becherer in Ber. Schweiz. Bot. Ges. l. 413 (1940) and by Mansfeld in Fedde, Repert. xlix. 47 (1940).

M. L. Fernald

EUPHORBIA SUBGENUS CHAMAESYCE IN CANADA AND THE UNITED STATES EXCLUSIVE OF SOUTHERN FLORIDA

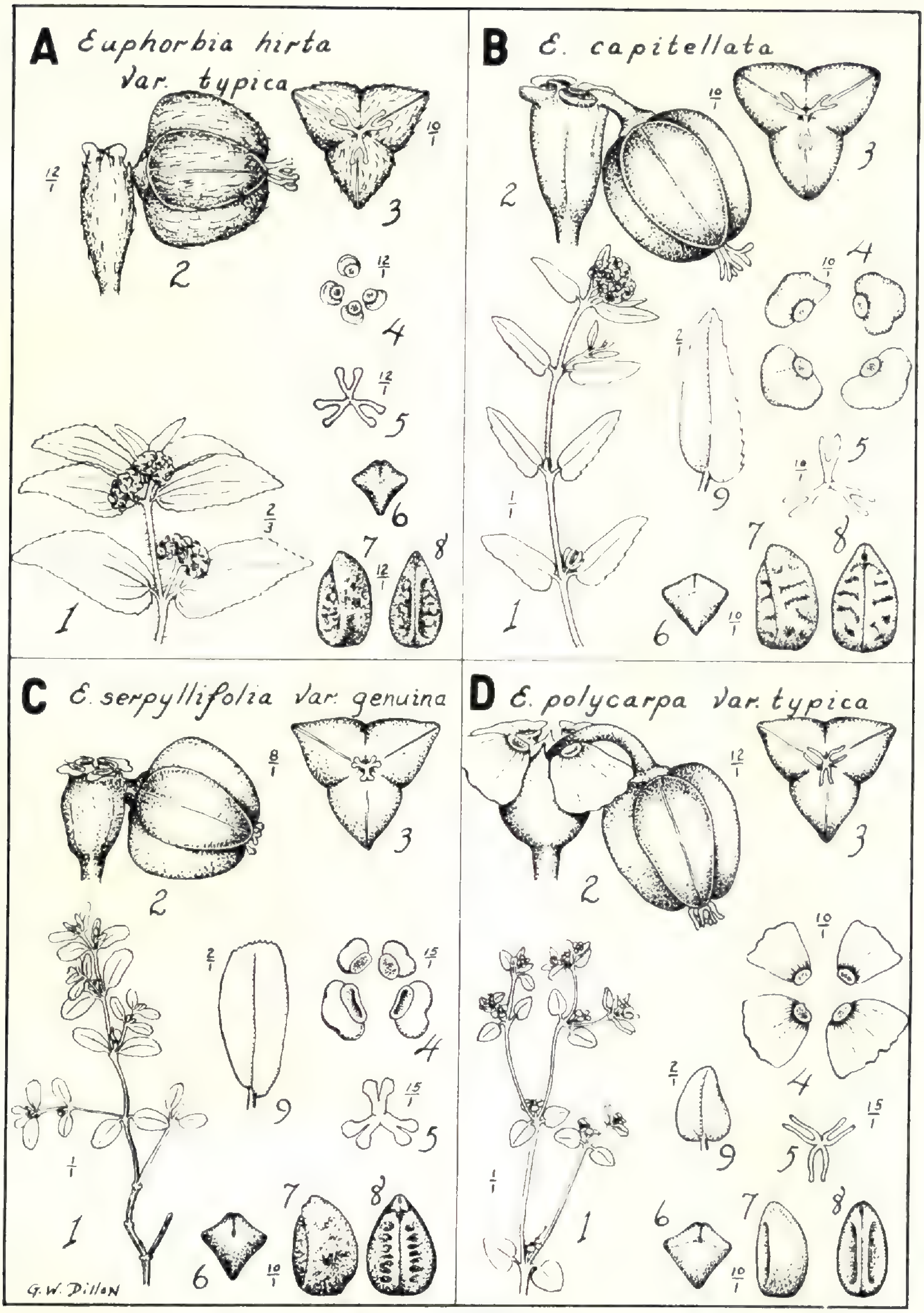
Louis Cutter Wheeler

(*Continued from page 154*)

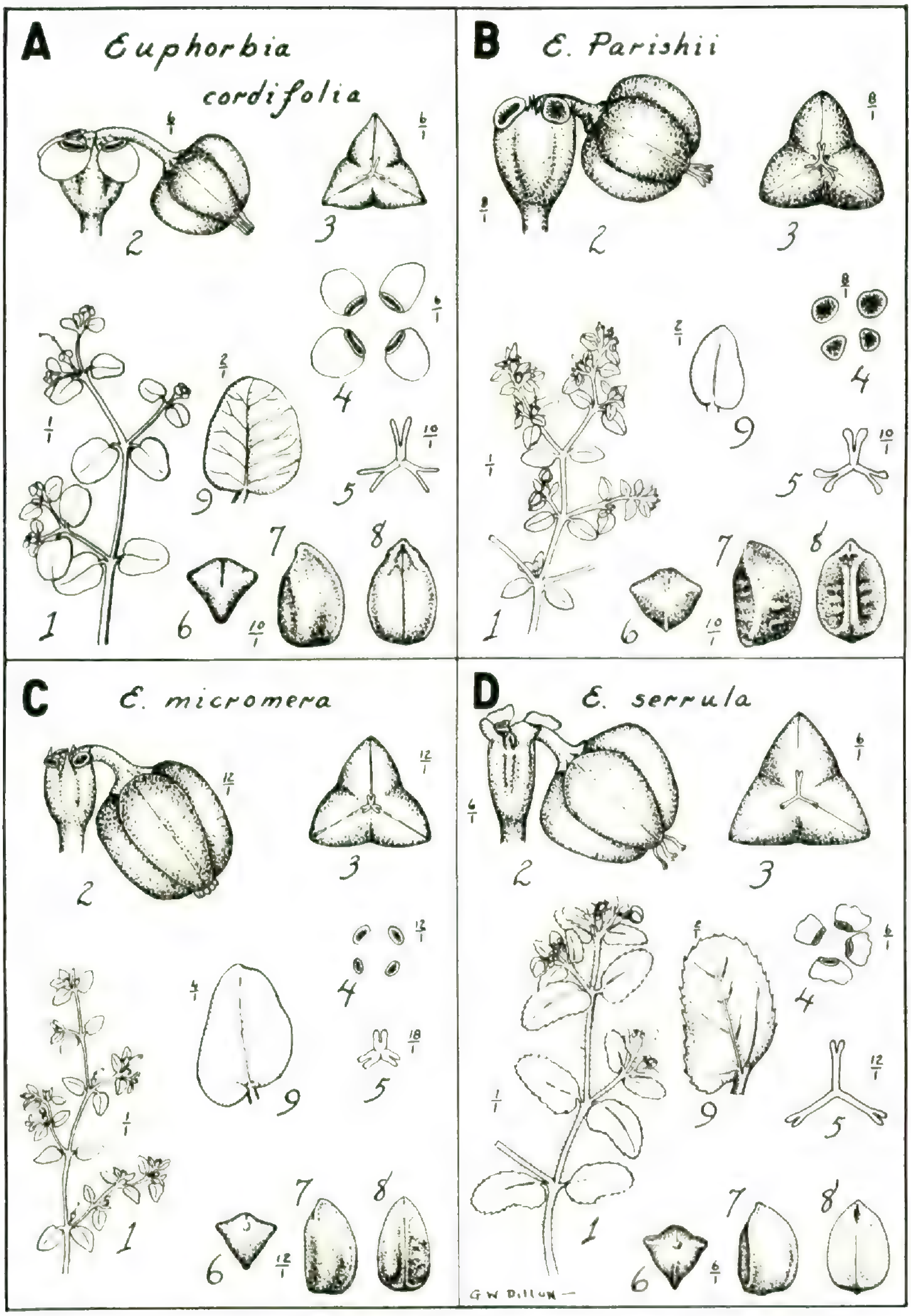
15. Euphorbia glomerifera (Millsp.) L. C. Wheeler, Contr. Gray Herb. **127:** 78. 1939; based on *Chamaesyce glomerifera* Millsp., Field Mus. Pub. Bot. **2:** 377. 1913. Type: El Rancho, Dept. Jalapa, Guatemala, alt. 1000 ft., Jan. 20, 1908, *W. A. Kellerman 8053* (F 224827! [a "6" is pencilled after the stamped herbarium number; why?]). A very robust specimen.

E. hypericifolia L. *sensu* most authors not only under *Euphorbia* but also *Anisophyllum* and *Chamaesyce.* See Contr. Gray Herb. **127:** 73–74. 1939 concerning the corrrect application of this name.

Glabrous, annual, or perhaps sometimes of slightly longer duration; stems erect, with occasional branches below, 12–50 cm. tall, from 1 mm. thick above to 4 mm. thick and slightly woody below, internodes 2–4.5 cm. long on the main stem; leaf-blades prevailingly oblong-oblanceolate but varying from oblong and oblong-spatulate to lanceolate, 1–3.5 cm. long, margin serrate or serrulate especially toward the apex and on the lower margin, base oblique; petioles 1–1.5 mm. long; stipules distinct or united, triangular, membranous, brown, 1–2 mm. long, sometimes ciliate on the inner edge; cyathia clustered in lateral and terminal cymes of mostly several to numerous cyathia; peduncles 0.6 to rarely as much as 4 mm. long, glabrous; involucre obconical, tapering gradually to the peduncle, 0.4–0.9 mm. in diam., glabrous outside, glabrous inside except for occasional short hairs at the bases of the lobes and stipes and sometimes a few above the middle of the involucre on the vascular trace leading to the gland; lobes triangular-attenuate, markedly exceeding the glands, mostly with 1–4 linear erect lateral lobes above; glands subcircular, from the merest microscopic point to 0.2 mm. in diam., on long stipes; appendages white, rotund and thrice as wide on the larger to completely wanting on the smaller glands, but some present on most of the cyathia; fifth gland from minute linear segment ¼ as long as the lobes to wholly wanting; sinus U-shaped, scarcely or not at all depressed; bracteoles from a membranous structure 2–3-parted above to a mere filiform segment opposite each gland or often wanting in some of the intervals, adnate below to the involucre, glabrous or with a few short hairs on free portion; staminate flowers 2–20 or wholly wanting in some cyathia; androphores glabrous, 1–1.1 mm. long; gynophore glabrous and sometimes reflexed; ovary glabrous, 3-lobed;



WHEELER ON EUPHORBIA



Wheeler on Euphorbia

styles glabrous, bifid to about the middle, subclavate, ca. 0.4 mm. long; capsules depressed-globose, roundly 3-lobed, glabrous, 1.3–1.4 mm. long, widest at about the equator; seeds ovoid-triangular, 0.9–1 mm. long, ca. 0.5 mm. tangentially and radially, radially ovate, facets with slight irregular depressions separated by very low smooth ridges, gelatinous coat so thin as to little obscure the light brown testa.—PLATE 656C.

Southern Florida and extreme southern Texas; Bermuda, West Indies, Central America, northern South America (British Guiana, Venezuela, and Colombia), and Hawaii (MAP 2). Representative specimens seen from the United States: FLORIDA. Dade Co.: Ft. Lauderdale, *Small & Carter 644* (NY); Miami, *Tracy 9127* (G, M, NY, US); Old Rhodes Key, *Small & Mosier 5699* (NY, US); Brickell Hammock south of Miami, *Small 4036* (NY); Buena Vista, *Moldenke 330* (M, NY, US); Soldier's Key, *Britton 330* (NY); hammocks between Miami & Cocoanut Grove, *J. K. & G. K. Small 4619* (NY). Monroe Co.: Ten Thousand Islands, *Simpson 388* (G, US); Doctor's Arm, Big Pine Key, *Simpson 310* (NY, US); Big Pine Key, *Killip 31582* (US); lower portion of Key Largo, *Small & Carter 3209* (NY); No Name Key, *Pollard, Collins & Morris 126* (NY, US); Upper Metacombe Key, *Curtiss 2486* (G, M, NY, US); West Summerland Keys, *J. K. Small, J. J. Carter & G. K. Small 3627* (NY). TEXAS. Hidalgo Co.: 8 miles south of Alamo, *Clover 783* (NY); near Swallow's Club House, south of Alamo, *Clover 1475* (NY). Cameron Co.: near Brownsville, *Ferris & Duncan 3129* (NY); Brownsville, *Clover 1537* (NY); southeast of Brownsville, *Clover 1524* (NY).

16. EUPHORBIA HIRTA L., Sp. Pl. **1:** 454. 1753.

Annual; stems mostly few, mostly erect to decumbent, sometimes prostrate, 2–60 cm. long, 1–1.5 mm. thick, strigose and commonly pilose with long yellow tapering hairs especially toward the stem-tips, internodes up to 7 cm. long but mostly 1–4; leaf-blades prevailingly broadly rhombic-lanceolate, varying from narrowly lanceolate to ovate, 4–40 cm. long, sparsely strigose and glabrate above, with appressed to spreading crisped hairs beneath, base strongly inequilateral, apex acute, margin sharply to bluntly serrate; petioles 1–2 mm. long; stipules triangular, long and slenderly attenuate, ca. 1 mm. long, distinct or barely united at the base, mostly with linear divisions below, with short scattered hairs; cyathia in dense pedunculate cymose heads of numerous cyathia; peduncles glabrous to sparsely strigose; involucre obconic-campanulate, 0.6–0.9 mm. in diam., upwardly strigose outside, glabrous inside or a few hairs on the inside faces of the stipes; lobes ciliate on the outer margin, triangular, mostly about equaling the glands, the margins lacerate into erect filiform segments; glands on long stipes, cupuliform to patelliform, circular to transversely oval, 0.15–0.3 mm. in

diam.; appendages white, glabrous, entire, from narrower than to twice as wide as the gland, or sometimes wholly absent; fifth gland ca. ½ as long as the lobes; sinus U-shaped, scarcely depressed; bracteoles sometimes reduced to one filiform segment below each gland but mostly forming a radial, upwardly expanding partition adnate for ca. ⅔ its length to the involucre below the glands, free portion parted into few linear shortly hairy segments shorter than the androphores; staminate flowers 2–8 per cyathium; androphores glabrous, 0.9–1 mm. long; gynophore glabrous, shortly exserted and mostly reflexed; ovary shortly strigose upwardly, 3-lobed; styles glabrous, bifid ½–⅔, 0.2–0.4 mm. long, slightly clavate; capsule 1–1.15 mm. long, sharply 3-angled, wider below the middle, shortly strigose, base truncate; seeds sharply quadrangular, 0.7–0.9 mm. long, 0.5–0.6 mm. tangentially and radially, ovate-acute radially, base truncate, facets with sub-regular to quite irregular low smooth wrinkles, ventral facets concave, dorsal concave to plane, microreticulate white coat often so thin as to little obscure the light brown to tan testa.

KEY TO VARIETIES

Cymules (clusters of cyathia) both terminal and lateral (except in depauperate plants), on *leafless* peduncles; stems sparingly branched above the base, unbranched at the tip; mostly robust erect plants with large leaves . . . . a. var. *typica*.
Cymules terminal or, if lateral, on *leafy* branchlets; stems branching freely, often forking symmetrically (or nearly so) at the tip; mostly low plants with small leaves . . . . b. var. *procumbens*.

16a. E. HIRTA L., Sp. Pl. **1:** 454. 1753, var. TYPICA L. C. Wheeler, Contr. Gray Herb. **127:** 68. 1939. TYPE: source unknown (Linnaean Herb., not seen; photograph G!; rephotograph W!). Quite typical of this widespread entity.—*E. capitata* Lam., Encyc. Meth. Bot. **2:** 422. 1786, substituted for *E. hirta* on the ground that the name was bad.—*Chamaesyce hirta* (L.) Millsp., Field Mus. Pub. Bot. **2:** 303. 1909.—*E. pilulifera* L. I *hirta* (L.) Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 425. 1917.

E. globulifera HBK., Nov. Gen. et Sp. **2:** 56 (quarto), 45 (folio). 1817. TYPE: Cumana, Venezuela, *Bonpland 403* (Herb. Mus. Paris, not seen; fragment F!; photograph G!).

E. verticillata Velloso, Fl. Flum., 202. 1825, & vol. **5:** t. 16. 1827, not Poiret in Lam., Encyc. Meth. Bot. Suppl. **2:** 611. 1811. This disposal of the name is based on the plate cited.—*E. nodiflora* Steudel, Nom. Bot. ed. 2, **1:** 613. 1840.

E. pilulifera L. β *discolor* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 188. 1859. TYPE: "On the Sonoita [Creek] near Deserted Rancho," Santa Cruz County, Arizona, Sept. 16, 1851, *C. Wright 1842* (M 144667!; photographs G!, W!; ISOTYPES

G!, US p. p.!). Merely plants with red-spotted leaves.—*E. discolor* Engelm. ex Millsp., Field Mus. Pub. Bot. **2:** 402, 440. 1916 (without basinym) by error, as synonym of *Chamaesyce hirta.*—*E. pilulifera* L. *1.* ["Spielart"] *discolor* (Engelm.) Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 426. 1917.

Chamaesyce Rosei Millsp., Field Mus. Pub. Bot. **2:** 402. 1916. Type: along an arroyo in the vicinity of Alamos, Sonora, Mexico, Mar. 13, 1910, *Rose, Standley, & Russell 12728* (NY!; fragment F!; isotype F!). A rather stunted and perhaps overwintering plant probably belonging to a race found in Sonora and Sinaloa, rather intermediate between *E. hirta* vars. *typica* and *procumbens.*

E. pilulifera L. var. *guaranitica* Chodat & Hassler, Bull. Herb. Boiss., ser. 2, **5:** 679. 1905. Type: in regione cursus superioris fluminis Apa, Paraguay, Nov. 1901/2, *E. Hassler 7735* (Ge?, not seen; isotype G!). A low plant with smaller leaves than usual for var. *typica.*

E. pilulifera L. *sensu* Jacquin, Icones Pl. Rar. **3:** t. 478. 1786–93; Boiss. in DC. Prod. **15** (**2**)**:** 21. 1862; A. M. Marselt, Contribution à l'Étude Botanique, Physiologique, et Therapeutique de l'Euphorbia pilulifera, thèse pour le Doctorat en Medecine, Année 1884, No. 36, pp. VI, 62 [2], 2 plates; J. D. Hooker, Fl. Brit. India **5:** 251. 1887; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 423. 1917; Farwell, Rhodora **38:** 331–2. 1936; and many other authors under *Euphorbia, Anisophyllum, Chamaesyce,* and *Tithymalus.*

The following Australian forms probably belong here: *E. pilulifera* L. forma *rubromaculata,* f. *humifusa,* & f. *viridis* K. Domin, Bibliotheca Bot. Band. 22, Heft 89 (**4**)**:** 866. 1927.

Plate 657A. Casual and not persisting in Michigan and New York; South Carolina, Florida, Alabama, Arizona, West Indies, Mexico, south to Argentina; widely introduced in the Old World (Map 24). Representative specimens seen from the United States: Michigan. Wayne Co.: Detroit, *Farwell 8756* (G). South Carolina. Charleston Co.: Charleston, *Fernald & Long 9747* (G). Florida. Brevard Co.: Indian River region, *Fredholm 5517* (G). Hillsborough Co.: *Fredholm 6348* (G). Lake Co.: near Eustis, *Nash 157* (G). Lee Co.: Myers, *A. S. Hitchcock 326* (F, G). Manatee Co.: near Bradentown, June 2, 1890, *Simpson* (F). Monroe Co.: Upper Metacombe Key, *A. H. Curtiss 2496* (F, G). Orange Co.: *Fredholm 5429* (G). Palm Beach Co.: Palm Beach, *A. H. Curtiss 5395* (G). Pasco Co.: St. Leo, Mar. 24, 1927, *O'Neill* (M). Pinellas Co.: near St. Petersburg, *Deam 2762* (F, G). Seminole Co.: Sanford, Oct. 8, 1892, *Leeds* (F). Alabama. Mobile Co.: Mobile, *Dukes 6* (G); Mobile, Sept., 1878, *Mohr* (G). Arizona. Cochise Co.: near Fort Huachuca, Huachuca Mts., *J. G. Lemmon 2875* (F, G). Santa Cruz Co.: Tumacacori, *Harrison & Kearney 6022* (G, US);

base of Patagonia Mts., *Peebles, Harrison & Kearney 4653* (US); Nogales, *Harrison & Kearney 6026* (US); near Patagonia, *Kearney & Peebles 10172* (US).

16b. E. HIRTA L. var. PROCUMBENS (DC.) N. E. Brown in Thiselton-Dyer, Fl. Trop. Afr. **6** (**1**): 497. 1911; L. C. Wheeler, Contr. Gray Herb. **127:** 69, Pl. IV, C, fig. 2. 1939; based on *E. procumbens* DC., Cat. Pl. Hort. Monsp., 111. 1813, not Miller, Gard. Dict. ed. 8, *Euphorbia* 12. 1768. TYPE: probably a plant from the garden at Montpellier, France, (Geneva?, not seen).—*E. pilulifera* L. var. *procumbens* (DC.) Boiss. in DC. Prod. **15** (**2**): 21. 1862.—*Chamaesyce pilulifera* (L.) Small var. *procumbens* (DC.) Small, Fl. Se. U. S., 714, 1334. 1903. Since no authentic material has been seen it has been necessary to accept without confirmation the interpretation of Boiss. in DC. Prod. **15** (**2**): 21. 1862.

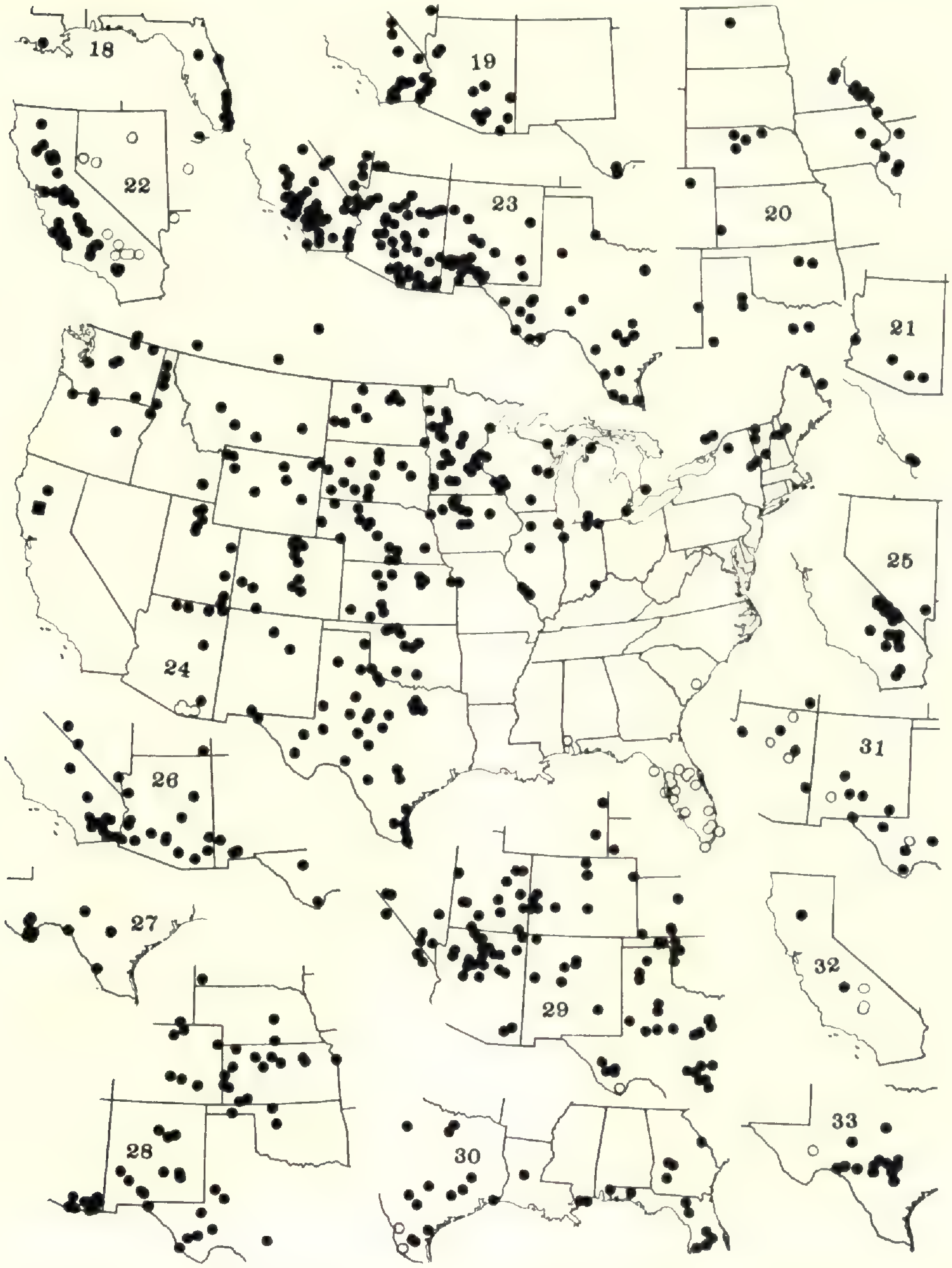
E. obliterata Jacquin, Enum. Syst. Pl. Carib., 22. 1762, & Select. Stirp. Amer. Hist., 151. 1763, at least in the sense in which it was used. *E. pilulifera* L. var. *obliterata* (Jacq.) A. S. Hitchcock, Ann. Rep. Mo. Bot. Gard. **4:** 127. 1893. No authentic material has been seen.

E. opthalmica Persoon, Syn. Pl. **2:** 13. 1807. TYPE: Rio de Janeiro, Brazil, July, 1767, *Commerson 238* (Herb. Mus. Paris, not seen; fragment F!). A small-leaved plant.

E. gemella Lag., Gen. et Sp. Nov., 17. 1816. TYPE: "Habit.[at] in N.[ova] H.[ispania]"; perhaps at Madrid judging by Alph. DC., Phytographie, 426. 1880. Supposed by Boiss. in DC. Prod. **15** (**2**): 21. 1862, and others, to be the same as *E. procumbens* DC.—*Chamaesyce gemella* (Lag.) Small, Fl. Miami, 110, 200. 1913.

Florida; adventive in Pennsylvania; Louisiana; Mexico, West Indies, and South America (MAP 18). Representative specimens seen from the United States: PENNSYLVANIA. Lancaster Co.: Columbia, April, 1876, *Garber* (F). FLORIDA. Brevard Co.: Meritt's Island, Indian River, *A. H. Curtiss 2496* (F, G). Broward Co.: Pompano, *Pease 26455* (G). Dade Co.: Miami, *Tracy 9115* (G); hammocks between Miami and Cocoanut Grove, *J. K. & G. K. Small 4694* (G); Elliott's Key, *Simpson 505* (F, G); Miami, *A. H. Curtiss 5849* (F, G). Monroe Co.: Pine Crest, *Moldenke 865* (M, NY). Palm Beach Co.: Kelsey City, *Fannie R. Randolph 135* (G); Palm Beach, May 20, 1895, *A. H. Curtiss* (G). LOUISIANA. Terrebonne Co.: Houma, Sept. 6, 1912, *Wurzlow* (F).

For a review of the evidence supporting the application of the name *Euphorbia hirta* to the species described above see my discussion in Contr. Gray Herb. **127:** 71–72. 1939. Also see op. cit., 78, for reasons for applying *E. pilulifera* L., which has been applied to the concept here called *E. hirta*, to an Old World plant.



MAP 18, range of EUPHORBIA HIRTA var. PROCUMBENS in U. S. but Pennsylvanian ballast plants omitted; 19, E. SETILOBA in U. S.; 20, E. GEYERI; 21, E. TRACHYSPERMA; 22, dots E. OCELLATA var. TYPICA, circles E. OCELLATA var. ARENICOLA; 23, E. ALBOMARGINATA in U. S.; 24, dots E. GLYPTOSPERMA, circles E. HIRTA var. TYPICA in U. S. but Michigan and New York waifs omitted, square E. OCELLATA var. RATTANII; 25, E. PARISHII; 26, E. MICROMERA in U. S.; 27, E. CINERASCENS in U. S.; 28, E. STICTOSPORA in U. S.; 29, dots E. FENDLERI var. TYPICA in U. S., circle E. FENDLERI var. TRILIGULATA; 30, dots E. CORDIFOLIA, circles E. LAREDANA; 31, dots E. FENDLERI var. CHAETOCALYX, circles intergrades between E. FENDLERI vars. TYPICA and CHAETOCALYX; 32, dots E. HOOVERI, circles E. VALLIS-MORTAE; 33, dots E. ANGUSTA, circle E. ASTYLA in U. S.

17. Euphorbia capitellata Engelm. in Emory, U. S. & Mex. Bound. Surv. **2 (1):** 188. 1859. Type: low valley at San Bernardino, Cochise County, Arizona, Oct. 3, 1851, *C. Wright 1849* (M 149810!; photographs G!, W!; isotypes G!, NY!). Rather lax and long-leaved; leaves nearly glabrous. Boissier in DC. Prod. **15 (2):** 22. 1862; L. C. Wheeler, Bull. Torr. Bot. Club **62:** 537. 1935.—*Chamaesyce capitellata* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 408. 1916.—*E. capitellata* var. *typica* L. C. Wheeler, Bull. So. Calif. Acad. Sci. **35:** 127. 1936.

E. pycnanthema Engelm. in Emory, U. S. & Mex. Bound. Surv. **2 (1):** 188. 1859. Type: on mountainsides near Lake Santa Maria, Chihuahua, Mexico, April 20, 1852, *C. Wright 186* (M 144666!; photographs G!, W!; isotypes G!, NY!). Compact and leaves pubescent. Boiss. in DC. Prod. **15 (2):** 22. 1862.—*Chamaesyce pycnanthema* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 411. 1916.

E. Rusbyi Greene, Bull. Calif. Acad. Sci. **2:** 57. 1886. Type: near Prescott, Yavapai County, Arizona, June 19, 1883, *H. H. Rusby 822* (probably destroyed in 1906 when the herbarium of California Academy burned, for no specimen is in the Herbarium Greeneanum at Notre Dame according to Dr. Theodor Just in letter of Feb. 25, 1939 filed at Gray Herbarium); isotype M!; photograph of isotype G!). Pubescent, small, and erect.—*Chamaesyce Rusbyi* (Greene) Millsp., Field Mus. Pub. Bot. **2:** 411. 1916.

E. geminiloba Millsp., Proc. Calif. Acad. Sci. ser. 2, **2:** 228. 1889. Type: Pozo de Los Dolores, Lower California, Mexico, Apr. 5, 1889, *T. S. Brandegee* (F 196142!, photograph G!, W!). A specimen with the tips of the branches missing and the leaves coarsely serrate.

Euphorbia pycnanthema forma *serrata* Millsp., op. cit., 222. 1889. "Pozo de Los Dolores, April 5th" 1889, Lower California, *T. S. Brandegee* (?). The type has not been located. At least an isotype may be expected at C. The description suggests that it was based on the same minor variant and perhaps even the same specimen as *E. geminiloba.*

E. capitellata var. *laxiflora* S. Wats., Proc. Amer. Acad. Arts & Sci. **24:** 74. 1889. Type: high mountains, Guaymas, Sonora, Mexico, 1887, *Ed. Palmer 210* (G!, isotype US!). Erect with long internodes and narrow glabrous leaves.

E. Chamberlinii I. M. Johnston, Proc. Calif. Acad. Sci. ser. 4, **12:** 1066. 1924. Type: Escondido Bay, Lower California, Mexico, June 14, 1921, *I. M. Johnston 4136* (CA 1288!). Has a distinctive appearance due to an abundance of white coccids.

E. gladiosa M. E. Jones, Contr. West. Bot. **15:** 144. 1929. Type: Guaymas, Sonora, Mexico, Nov. 2, 1926, *M. E. Jones 22613* (P!). The same variant as *E. capitellata* var. *laxiflora.*

Perennial; stems few to numerous, ascending to erect, 5–40 cm. long, 0.5–1.5 mm. thick, glabrous to pubescent, internodes up to 4.5 cm. long, mostly about 1 cm. long; leaf-blades ovate-acute to linear-lanceolate, 4–25 mm. long, glabrous to pubescent, base markedly inequilateral, margin entire to coarsely and sharply serrate; petioles ca. 1 mm. long; stipules mostly distinct, triangular- to subulate-attenuate, parted into a few erect linear segments, ciliate to pubescent, 1.5–2 mm. long; cyathia congested in cymose glomerules of several to many, or a few solitary in the upper bifurcations; peduncles pubescent to glabrous, 0.5–1 or rarely to 3 mm. long; involucre campanulate to broadly obconical-campanulate, 1.3–1.7 mm. in diam., glabrous to pubescent outside, hairy on the inside of the lobes and stipes; lobes narrowly triangular, acuminate, slightly to markedly exceeding the glands; glands circular to transversely oval, 0.2–0.45 mm. in diam., on long stipes; appendages white to pink, glabrous, entire, usually conspicuous; fifth gland linear, pubescent, ½–¾ as long as the lobes; sinus U-shaped, slightly depressed; bracteoles united and forming radial partitions adnate for ca. ⅔ their length to the involucre below the gland, free portion pubescent, entire to once parted; staminate flowers 28–41 per cyathium; androphores sparsely pubescent above, or glabrous, 1.6–1.9 mm. long; ovary slightly 3-lobed, mostly pubescent, sometimes glabrous; styles ½–⅔ bifid, glabrous or sometimes with a few hairs at the base, 0.6–0.7 mm. long; capsule pubescent to glabrous, 1.3–1.9 mm. long, subacutely 3-lobed, widest at the equator or slightly below; seeds quadrangular, 1.2–1.4 mm. long, 0.6–0.8 mm. tangentially, 0.6–0.7 mm. radially, narrowly ovate to very narrowly oblong-ovate radially, apex acute, base obtuse to truncate, facets with small shallow depressions or even sub-regular faint transverse wrinkles.—Plate 657B.

Arizona, western Texas, Chihuahua, Coahuila, Sonora, Sinaloa, Lower California (Map 45) Representative specimens seen: Texas. Brewster Co.: along Blue Creek, foot-hills of Chisos Mountains, *E. J. Palmer 34199* (M, NY); near Castolon, *Cory 1907* (G). Arizona. Coconino Co.: Ashfork to Williams, *Kearney & Peebles 12077* (G). Yavapai Co.: Prescott, *Rusby 317* (NY, US). Gila Co.: 6 miles east of Cassadore Springs, *Maguire, Richards & Moeller 13068* (I); Roosevelt Dam, *Eastwood 8668* (G). Pinal Co.: 2 miles below Coolidge Dam, *Maguire, Richards & Moeller 10431* (G, I); Picacho Mountains, *Peebles 6493* (NY); Graham Co.: Fairview, *M. E. Jones 4097* (G, I, NY, O, US); 10 miles west of Ash Creek Ranch, San Carlos Indian Reservation, *Maguire, Richards & Moeller 10375* (G, I). Pima Co.: near Colossal Caves, Tucson, *Maguire, Richards & Moeller 11699* (G, I); east of Ranger Station, Baboquivari Mountains, *Wiegand, Maguire, Richards & Moeller 10778* (I); near Tucson, May 3, 1883,

Pringle (NY, US), Apr. 8, 1881, *Pringle* (G, M, US), Oct. 27, 1905, *Tracy 8987* (G, M, NY, US), Oct. 29, 1905, *Tracy 8953* (G, M, NY, US). Santa Cruz Co.: Ruby to Nogales, *Peebles & Fulton 11446* (NY). Cochise Co.: near Fort Huachuca, near Huachuca Mountains, *Lemmon 3112* (G). MEXICO: Chihuahua: near Chihuahua, June 5–10, 1908, *Ed. Palmer 370* (G, US); near Chihuahua, June 5–10, 1908, *Ed. Palmer 376* (G); near Chihuahua, *Pringle 699* (G, US); 7 miles north of Charco Piedra, *Johnston 7931* (G). Coahuila: Monclova, Aug., 1880, *Ed. Palmer 1211* (G). Sonora: Guaymas, June, 1887, *Ed. Palmer 83* (G, US), Aug., 1887, *Ed. Palmer 142* (G, US), Oct., 1887, *Ed. Palmer 317* (G, US). Badebuache, *C. E. Lloyd 457* (G). Sinaloa: Culiacan, Aug. 27–Sept. 15, 1891, *Ed. Palmer 1517* (G, US). Lower California: Concepcion Bay, *Johnston 4173* (G, US); 30 miles south of Mulege, *Shreve 7096* (G).

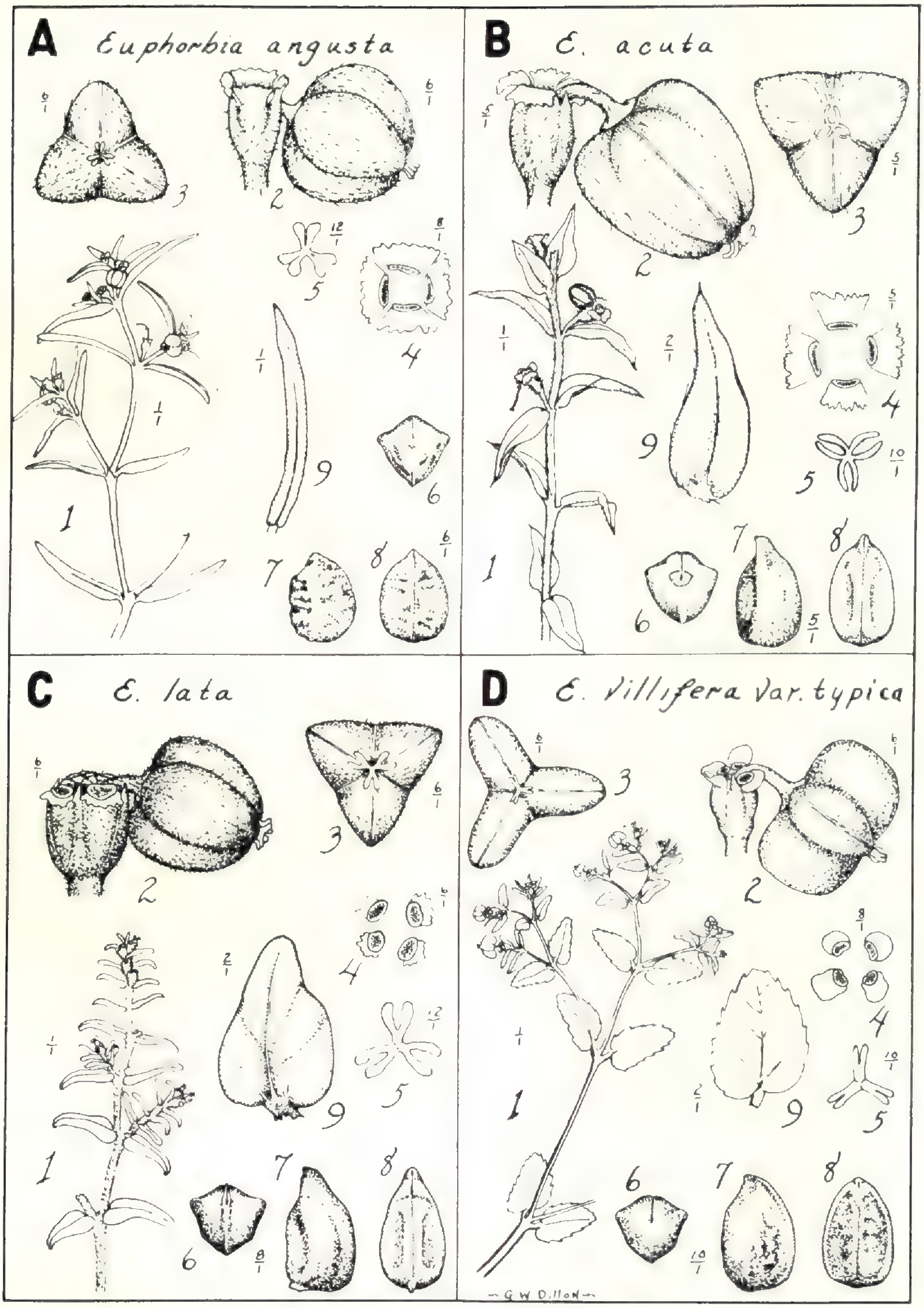
In Bull. So. Calif. Acad. Sci. **33:** 105–6. 1934, I had provisionally accepted the data on a specimen of this species which claimed to have come from an altitude of 6000–8000 feet in the San Jacinto Mountains, Riverside County, California. In view of the fact that this is the only collection purporting to have come from California and that it is far above the life zone in which it occurs in adjacent regions I am now refusing to accept as valid the data of this collection.

This species is as polymorphic as *E.pediculifera.* Both have a linear-leaved variation centering about Guaymas, Sonora. Perhaps the linear-leaved variation in one is of as much consequence as in the other. However, with some hesitation I have concluded that *E. capitellata* var. *linearifolia* is too vague and ill-defined for recognition due to the great number of intermediates in all characters.

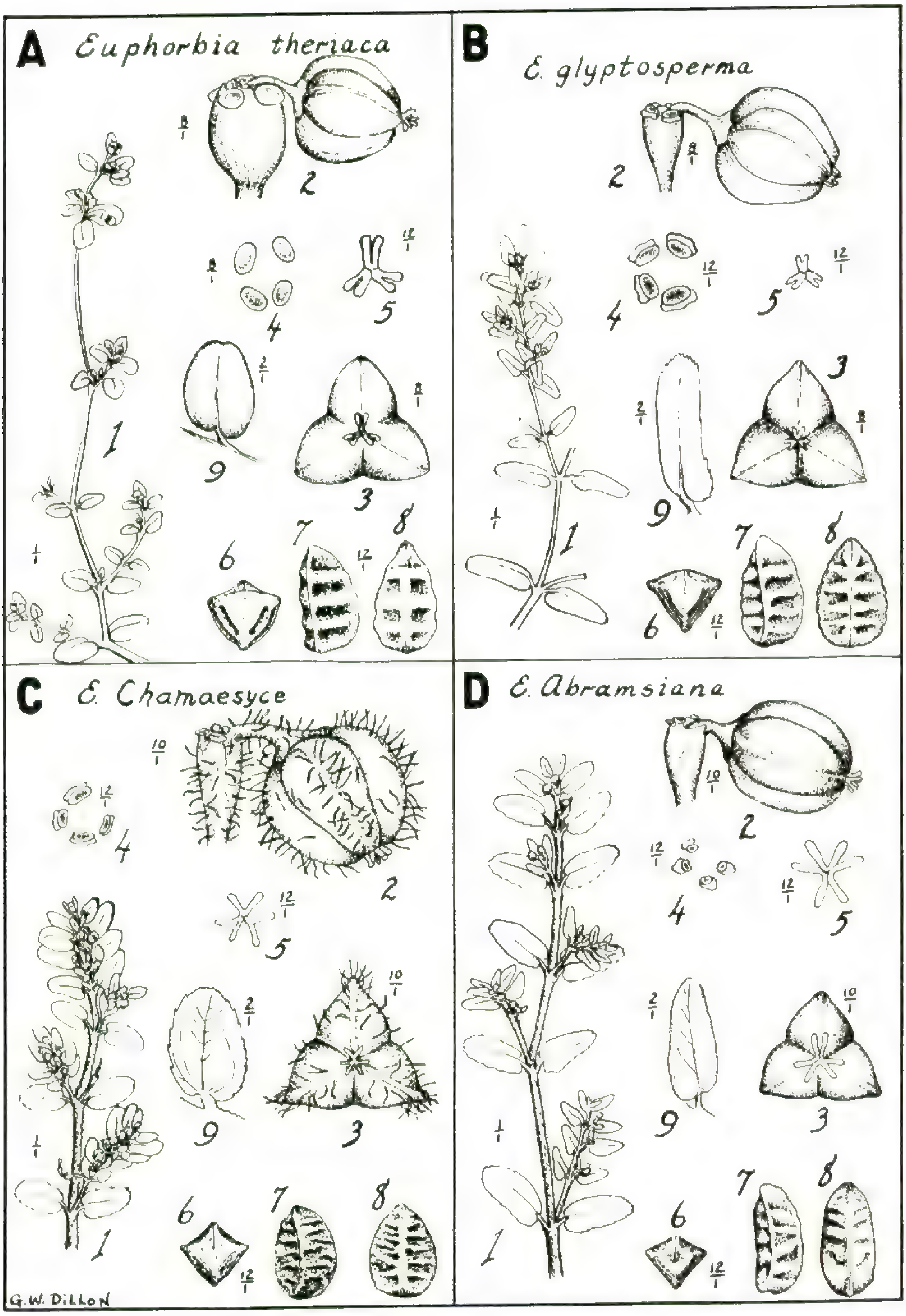
18. Euphorbia acuta Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**)**:** 189. 1859. Boiss., Icon. Euph., t. 6. 1866. Type: "N. Mex.", 1851, *C. Wright 1839* (M 149791!; fragment F!). A good representative of the species.—*Chamaesyce acuta* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 407. 1916.

E. acuta var. *stenophylla* Boiss. in DC. Prod. **15** (**2**)**:** 18. 1862. Type: limestone hills in the Big Bend of Devil's River, Texas, Nov., 1852, *C. Wright 1840* (Ge!; photographs G!, W!; isotypes G!, M!, US!). A narrow-leaved extreme intergrading completely.

Perennial from a farinaceous taproot as much as 1.5 cm. thick; stems annual, erect or ascending, numerous, 10–30 cm. long, to 1.5 mm. diam., with long weak hairs partially deciduous in age, internodes 1–4 cm. long; leaves sessile or subsessile, sparingly



WHEELER on EUPHORBIA



Wheeler on Euphorbia

long-villous to densely appressed-tomentose below, less so and glabrate above, mostly 1–2 cm. long, ovate-lanceolate to lanceolate, base subsymmetrical, apex long-acuminate, cartilaginous at the extreme tip, margin sometimes strongly revolute; stipules apparently wanting; peduncles stout, to 2 mm. long, sparingly to densely villous; cyathia solitary at the nodes; involucres turbinate, 1.7–2.5 mm. diam., sparsely to markedly villous without, with fine short hairs within; lobes narrowly deltoid and entire, or broader and two-toothed, equaling or slightly exceeding the glands; glands transversely elongate, slightly concave, ochroleucous, the proximal 1–1.5 mm. long, the distal shorter; appendages mostly as wide as to wider and longer than the glands, glabrous, white, margin with irregular short blunt teeth; fifth gland totally absent; sinus somewhat depressed, U-shaped; bracteoles 3–5 opposite each gland, united at the base and sometimes throughout, of various lengths, some usually nearly equaling the glands, long-hairy; staminate flowers 4–5 per fascicle, 20–25 per cyathium; androphores 2.2–2.5 mm. long, slightly exserted, with from few to numerous slender hairs throughout; gynophore hairy, exserted and reflexed at maturity; ovary densely white-hairy, styles glabrous, ca. 1 mm. long, parted to the middle, divisions somewhat flattened, recurved; capsule sharply three-lobed, 3 mm. long and in diam., short-appressed-hairy; seeds quadrangular, ovate radially, 2.2–2.5 mm. long, 1.5–1.7 mm. tangentially, 1.5 mm. radially, base oblique, coat white, microreticulate.—Plate 659B.

Southern New Mexico, western Texas, and northern Coahuila (Map 35). Representative specimens seen: New Mexico. Sierra Co.: Lake Valley, 1915, *Beals* (US). Eddy Co.: east of Carlsbad, *Standley 40287* (US). Texas. Brewster Co.: Agua Fria road, *Cory 1915* (G); south of Alpine, *Cory 18593B* (G). Crockett Co.: Ozona, *M. E. Jones 26015* (M). Edwards Co.: Barksdale, *E. J. Palmer 10984a* (US). Kinney Co.: *Cory 508* (G). Pecos Co.: northeast of Fort Stockton, *Cory 1914* (G). Presidio Co.: Marfa, June 9, 1895, *Plank* (NY). Reeves Co.: Pecos City, *Neally 719* (US). Terrell Co.: Sanderson, *Orcutt 765* (US); Dryden, *Cory 2273* (G). Uvalde Co.: west of Uvalde, *M. E. Jones 28439* (M); Utopia, 1916, *E. J. Palmer 10228* (US); near Uvalde, *E. J. Palmer 33618* (NY, US). MEXICO: Coahuila: near Diaz, *Pringle 8278* (G, M, NY, US); 100 miles north of Monclova, Sept., 1880, *Ed. Palmer* (G); 17 miles south of Allende, Aug., *Johnston 7028* (G); at foot of eastern slope of the Sierra de Puerto Santa Ana, *Wynd & Mueller 243* (M, NY, US). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 435. 1936.

There seems to have been some confusion about the collections

referred to this species. Engelmann in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 189. 1859, states "Stony prairies western Texas, along the San Pedro and Pecos river, &c.; *Bigelow, Schott.* (No. 1739 and 1749, Wright.)" There are before me what are presumably all the specimens of this species from the United States in the Herbarium of Missouri Botanical Garden. Yet none of the collections cited is in the suite. However, there is *Wright 1839* which I am taking as type. The most plausible explanation which occurs to me is that someone made a mistake in numbering some of these collections. All the other *Euphorbiae* of Wright's collections of the years 1851–2 bear numbers in the eighteen hundreds. (They were numbered phylogenetically by Asa Gray.) There are sheets at G, NY, and US bearing the number 1739. At both G and US someone has queried this number and added 1839. Just how Engelmann managed to cite No. 1739 when the sheet in his herbarium bore only the number 1839 is not clear. Engelmann's citation of number 1749 is even more puzzling. He did have a number 1840 which by a combination of poor handwriting and perhaps unknown circumstances was evidently converted into 1749. However, the problem can be dealt with very simply after the obvious assumption is made that there were errors in the numbers. *Wright 1839* is taken as type since it is a good specimen and entirely representative of the species. *Wright 1840* is the type collection of *Euphorbia acuta* var. *stenophylla* Boiss. and represents a narrow-leaved extreme of the species. The usual methods of elucidating the source of Wright's collections fail completely in this case. Of the three original numbers found, all came from Western Texas. It appears very likely that the material distributed as No. 1839 (or 1739) may have been from more than one of Wright's collections.

19. Euphorbia angusta Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 189. 1859. Type: Rocky bluffs at camp in big bend of the San Pedro (now Devil's) River, probably Valverde Co., Texas, May 21, 1851, *C. Wright 1828* (M 149804!, photographs G!, W!; isotypes G!, NY!. US!). A satisfactory representative of the species. Boiss. in DC. Prod. **15** (**2**): 18. 1862, & Icon. Euph., t. 7. 1866.—*Chamaesyce angusta* (Engelm.) Small, Fl. SE U. S., 711, 1333. 1903.

Perennial; stems several to numerous, erect, 12–43 cm. tall, thinly to densely short-strigose, 1–2 mm. thick above the base, often simple below and branching only above, internodes rarely

up to 8 cm. long but mostly not over 2–4 cm. long and gradually shorter upward; leaf-blades of three completely intergrading sorts, (1) the basal, ovate to elliptic-oblong, 7–15 mm. long, (2) the median, elliptic-linear to linear, acuminate, 2–4 cm. long, (3) the upper, linear, often involute on drying, 4–10 mm. long, all entire (with the exception of a few serrulate basal leaves on one plant), strigose to glabrous, especially on the upper surface; petioles 0.5–1.5 mm. long; stipules tardily deciduous, distinct, consisting of brown segments arising from interpetiolar portion of the amplexicaul petioles, bearing a few short hairs, longest segments 0.6–0.9 mm. long; peduncles 1–3 mm. long, strigose; cyathia at the upper nodes, solitary; involucres narrowly campanulate to obconical, tapering to the peduncles, 1.3–1.6 mm. in diam., strigose outside, strigose inside except on the lower half beneath the lobes; lobes short, triangular, little exceeding the glands, small and densely hairy; glands narrowly transversely oblong, 0.4–0.6 mm. long, strongly depressed in the middle, appendages ascending, white, 0.3–0.7 mm. wide, longer than the glands, with a few short appressed hairs beneath at the base, outer margin truncate, shallowly and irregularly toothed; fifth gland absent, sinus U-shaped, strongly depressed; bracteoles united at the base into a tuft adnate below to the involucre beneath the glands, densely hairy, a little shorter than the androphores; staminate flowers 16–26 per cyathium; androphores 1.3–1.4 mm. long, mostly, i. e., some in each cyathium, with sparse fine hairs; gynophore strigose, shortly exserted and usually reflexed; ovary 3-lobed, densely appressed-hairy; styles obliquely spreading to erect, 0.4–0.6 mm. long, bifid only at the stigmatic apex to ⅓ to the base, with short appressed hairs at the base; capsule strigose, 2.1–2.4 mm. long, wider than long, deeply roundly to subacutely 3-lobed, wider below the equator; seeds quadrangular, 1.6–1.9 mm. long, 1.1–1.4 mm. tangentially, 1.3–1.4 mm. radially, ovate to broadly ovate radially, base obtuse to truncate, angles blunt but definite, ventral facets plane or concave, dorsal slightly convex, both traversed by few to several low irregular transverse ridges, coat off-white to chalk-white, microreticulate, testa dark gray.—Plate 659A.

Local in the Edward's Plateau region, western Texas (Map 33). Representative specimens seen: Texas: Bandera Co.: Medina Lake Hills, *Tharp 6013* (US). Bexar Co.: on the Cibolo and Sabinas (near San Antonio), *Lindheimer 429* (G, M). Comal Co.: bed of Cibolo River, Bracken, *Groth 131* (G, NY, US). Comanche Co.: Comanche Spring, June 1849, *Lindheimer* (G, M). Edwards Co.: Ranch Expt. Station, *Cory 3188* (G). Hays Co.: San Marcos & vicinity, May, 1897, *Stanfield* (NY). Kerr Co.: Turtle Creek, *Bray 276* (US); Kerrville, *Heller 1738* (G, M, NY, US). Llano Co.: Llano, *E. J. Palmer 10287* (US). Tom

Green Co.: Knickerbocker Ranch, Dove Creek, *Tweedy 258* (US). Travis Co.: Mt. Burnell, Austin, *Hall 559* (G, M, NY, US). Valverde Co.: Devil's River, *Orcutt 6040* (M); mouth of Pecos River, *Cory 26701* (G). Wilson Co.: Sutherland Springs, Aug., 1879, *Ed. Palmer* (G).

20. Euphorbia lata Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 188. 1859; based on *E. dilatata* T. & G., Rep. Expl. & Surv. Railr. Miss. R. to Pacific Ocean **2** (**4**): 175. 1855, not Hochst. ex A. Richard, Tent. Fl. Abyss. **2**: 240. 1851.[1] (*E. dilatata* E. Meyer in Drege, Flora, Jena **26**: Besondere Beigabe 184. 1843, has been given as preoccupying but is a *nomen nudum.*) Type: a specimen bearing only the data "Pope's Expedition"; (NY!; photographs G!, W!; probable isotype at G! bears the data "Ex coll. Geo. Thurber, Texas, Pope").—*Alectoroctonum dilatatum* (T. & G.) Klotzsch and Garcke, Abh. Akad. Berlin, Phys. **1859**: 39. 1860.—*Chamaesyce lata* (Engelm.) Small, Fl. Se. U. S., 710, 1333. 1903.

E. rinconis M. E. Jones, Contr. West. Bot. **12**: 76. 1908. Type: Rincon, Doña Ana County, New Mexico, 1890, *M. E. Jones* (P!). This is in no wise different.

Perennial, herbage with short appressed hairs; stems ascending or erect, 10–15 cm. long, 0.5–1 mm. thick; internodes 0.5–2 cm. long; leaf-blades ovate-deltoid-falcate to long-deltoid or virtually linear in some cases by revolution of the margins, margin entire, more or less revolute; petioles ca. 1 mm. long; cyathia solitary at the nodes; involucres turbinate, 1.7–2 mm. in diam., with short appressed hairs without, glabrous within except above; lobes deltoid, entire, equaling or exceeding the glands; glands transversely oblong, ca. 0.5 mm. long, hairy beneath; appendages absent or very narrow, white, crenate; fifth gland minute or absent, with a tuft of hairs in its interval; sinus somewhat depressed; bracteoles united below into one radial appendage adnate below to the involucre opposite each gland, 4–7 parted above, not quite equaling the glands, with straight long slender hairs above; staminate flowers 5–7 per fascicle, 25–35 per cyathium; androphores 1.9–2.2 mm. long, equaling the glands, with numerous hairs above; gynophore hairy, shortly exserted and reflexed at maturity; ovary with short appressed hairs, three-angled; styles ca. 0.75 mm. long, parted to or below the middle, with very short hairs below; capsule sharply three-lobed, with appressed hairs, ca. 2.5 mm. long, 2.5 mm. in diam.; seeds quadrangular, 2 mm. long, 1 mm. radially and tangentially, long-deltoid radially, back rounded, raphal ridge straight in tangential silhouette, base obtuse-truncate, angles sharp, facets smooth, depressed, coat white, microreticulate.—Plate 659C.

Plains of Kansas, south to Texas, west to Colorado and New

[1] Date fide Pritzel, Thes. Lit. Bot. ed. 2, 240. 1872.

Mexico (MAP 36). Representative specimens seen: KANSAS. Morton Co.: on Cimarron River, north of Elkhart on Point Rock, *Rydberg & Imler 944* (M, NY). TEXAS. Brewster Co.: 17 miles south of Alpine, *Cory 9294* (G). Coleman Co.: Coleman, April, *Reverchon 1355* (M, NY). Coryell Co.: gravelly hills, Eagle Springs, *Bigelow* (NY). Culberson Co.: near Kent, *Earle & Tracy 381* (NY); Signal Peak, Guadalupe Mountain, *Whitehouse 502* (NY). Hudspeth Co.: *Cory 1921* (G). Jeff Davis-Brewster Co.: mountain slopes between Alpine and Fort Davis, *Small & Wherry 12047* (NY). Martin Co.: near Stanton, June 12, 1900, *Eggert* (M). Mitchell Co.: north of Colorado, June 8, 1900, *Eggert* (M). Potter Co.: prairies, Amarillo, May 28, 1902, *Reverchon* (M). Presidio Co.: *Cory 1919* (G). Randall Co.: west Canyon City, Aug. 12, 1900, *Eggert* (M). Reeves Co.: plains west of the Pecos, *Earle & Tracy 104* (Mo, NY). Taylor Co.: north Abilene, June 7, 1900, *Eggert* (M). Tom Green Co.: San Angelo, *E. J. Palmer 10310* (M). County?: near the Sabinal, May 13, 1851, *C. Wright 1841* (G, M, NY). COLORADO. Baca Co.: 19 miles north Boise City, Oklahoma in Colorado state, *Stratton 441* (M). NEW MEXICO. Chaves Co.: Rosswell, alt. ca. 3800 ft., *Earle 343* (NY). Doña Ana Co.: Organ Mountains, *Vasey* (M). Lincoln Co.: Carrizozo, *Earle 592* (NY). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 434. 1936. Formerly, l. c., I included some collections from Coahuila in this species. They are not at hand now. *Palmer 1205* in 1880 at G is *E. fruticulosa* Engelm.

Wright no. 1841 would have been preferable as type as far as locality-data are concerned. However, the collection chosen as type is accompanied by drawings and notes of diagnostic characters and the plants are in far better condition. Consequently, since the description seems to have been drawn from these plants, I have taken them as type. The specimens were very likely collected on the Pope Expedition in Texas somewhere near the thirty second parallel of north latitude.

21. EUPHORBIA GOLONDRINA L. C. Wheeler, Proc. Biol. Soc. Wash. **53:** 8. 1940. TYPE: along sandy beach at entrance to Boquillas Canyon, Chisos Mountains area, Brewster County, Texas, Aug. 5, 1937, *B. H. Warnock 998* (US 1726028!; fragments G!; photographs G!, W!).

Annual, glabrous; stems prostrate, to 15 cm. long, 0.7–1.5 mm. thick, internodes up to 2 cm. long; leaf-blades mostly 6–9 mm. long, oblong to narrowly oblong or even narrowly elliptic, entire, base inaequilateral; petioles ca. 1 mm. long, amplexicaul; stipules 0.7–1 mm. long, mostly glabrous, ventral united into a median, subulate, often bifid structure, dorsal distinct, linear; peduncles

1–1.5 mm. long; cyathia solitary at the nodes; involucres turbinate, 1.1–1.3 mm. diam., glabrous without, glabrous within except for short hairs at base of lobes, gland-stipes and a line extending half-way down below the stipes; lobes slenderly deltoid-attenuate, not quite equaling the glands; glands subcircular or a little longer than wide, deeply concave, sometimes folded together, 0.3–0.5 mm. in diam.; appendages white, glabrous, entire, forming a semi-lunate margin to the gland, 0.2–0.5 mm. wide; sinus U-shaped, slightly depressed, short-hairy; 5th gland linear, equaling the lobes and clothed like them; bracteoles more or less united together below and adnate to the involucre, free ends linear, short-hairy; staminate flowers 7–10 per fascicle, 39–50 per cyathium; androphores ca. 1.5 mm. long, glabrous; gynophore glabrous, exserted and reflexed at maturity; ovary glabrous, obtusely 3-angled; styles ca. 0.4 mm. long, glabrous, parted nearly to the base, slightly clavate; capsule broadly ovoid, glabrous, 3-angled, ca. 1.8 mm. long; seeds 1.6–1.8 mm. long, subquadrangular, narrowly ovate radially, base truncate, ca. 0.8 mm. radially and tangentially, facets slightly convex, irregularly wrinkled, dorsal and lateral angles blunt, raphe so low and blunt as to scarcely separate the front facets.—PLATE 664A.

Known only from the type (MAP 37).

22. EUPHORBIA PEDICULIFERA Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 186. 1859.

Perennial from a taproot stout in age; stems prostrate to erect, appressed-pubescent, glabrate in age, up to 2 mm. in diam. toward the base, internodes up to 5 cm. long, often very short toward the stem-tips thus congesting the cyathia; leaves closely appressed-pubescent, or sometimes closely tomentose, to subglabrous, blades 2–37 mm. long, 1–10 mm. wide, ovate with oblique base, oblong with subsymmetrical base to spathulate and even narrowly linear with symmetrical base, petioles 1–2 mm. long, amplexicaul on ventral side of stem; stipules mostly less than 0.5 mm. long, the ventral united, the upper distinct; peduncles clothed as the leaves, up to 1.5 mm. long; cyathia solitary at the nodes, sometimes congested at the branch-tips by shortening of the terminal internodes but not strictly glomerulate; involucres campanulate, 1.5–2 mm. long, closely appressed-pubescent to sub-glabrous without, more or less short-hairy within above; lobes deltoid, hairy, equaling the glands; glands transversely oblong, 0.5 mm. wide, 0.75–1.25 mm. long, dark red-purple; appendages absent or up to 2 mm. wide and 3 mm. long, entire or slightly lobed, glabrous; fifth gland very short or usually absent; sinus U-shaped, hairy, little depressed; bracteoles shorter than the androphores, usually very hairy above, in one group of 6–8 opposite each gland, united at the base and adnate to the involucre; staminate flowers 4–5 per fascicle, 22–25 per cyathi-

um; androphores ca. 1.25 mm. long, included or shortly exserted, glabrous or with few hairs above; gynophore nearly glabrous or hairy nearly throughout, exserted and reflexed at maturity; ovary very slightly lobed, densely hairy, tapering upward; styles ca. 1 mm. long, slender, parted to the base, short-hairy on the lower side to the tip; capsule appressed-pubescent, widest below the middle, 2 mm. in diam. and long, markedly three-lobed, the lobes obtuse; seeds slenderly ovoid, 1–1.3 mm. long, 0.6–0.7 mm. diam., encircled by 4 or 5 rounded ridges with V-shaped channels between, coat white.

Key to Varieties

Leaves ovate to lanceolate with obtuse apex, rarely over 2 cm. long; bracteoles 6–8, united only at base and conspicuous. . .a. var. *typica*.
Leaves strictly linear, often over 2 cm. long, up to 3.7 cm. long; bracteoles usually inconspicuous, if conspicuous united upward . . . . b. var. *linearifolia*.

22a. E. pediculifera Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 186. 1859, var. typica L. C. Wheeler, Bull. Torr. Bot. Club **63:** 442. 1936. Type: "On the Sonoita [Creek] near Deserted Rancho," Santa Cruz County, Arizona, Sept. 15, 1851, *C. Wright 1848* (M 144671!; photographs G!, W!; isotypes G!, NY!). A very good representative of the species with short broad leaves and medium-sized appendages.—*Chamaesyce pediculifera* (Engelm.) Rose & Standley, Contr. U. S. Nat. Herb. **16:** 12. 1912.

E. involuta Millsp., Proc. Calif. Acad. Sci., ser. 2, **2:** 227. 1889. Type: Comondu, Lower California, Apr., 1889, *T. S. Brandegee* (F 196145!; photographs G!, W!; isotype C!). A plant from which the larger leaves have fallen.—*Chamaesyce involuta* (Millsp.) Millsp., Field Mus. Pub. Bot. **2:** 410. 1916.—*E. pediculifera* Engelm. var. *involuta* (Millsp.) I. M. Johnston, Proc. Calif. Acad. Sci., ser. 4, **12:** 1070. 1924.

E. conjuncta Millsp., Proc. Calif. Acad. Sci., ser. 2, **2:** 227. 1889. Type: Purisima, Lower California, Feb. 12, 1889, *T. S. Brandegee* (F 196147!; photographs G!, W!; isotypes C!, G!). Leaves somewhat narrowed at the base, which is not unusual.—*Chamaesyce conjuncta* (Millsp.) Millsp., Field Mus. Pub. Bot. **2:** 408. 1916.

E. pediculifera Engelm. var. *inornata* T. S. Brandegee, Zoe **5:** 209. 1905. Type: Cofradia, vicinity of Culiacan, Sinaloa, Mexico, Oct. 23, 1904, *T. S. Brandegee* (C!; isotypes F!, G!). A minor variant with appendages of glands lacking and rather short internodes.

E. vermiformis M. E. Jones, Contr. West. Bot. **16:** 23. 1930. Type: Ajo, Pima County, Arizona, Sept. 18, 1929, *M. E. Jones 24856* (P!; isotypes G!, NY!). A variant with long internodes

and long narrow leaves approaching *E. pediculifera* var. *linearifolia*.—Plate 664C, figs. 1–9.

Colorado Desert, California, southern Arizona, Baja California, Sonora, and Sinaloa (Map 6). Representative specimens seen: California. Imperial Co.: upper end of Painted Gorge, Carisso Mountains, *Ferris & Rossbach 9624* (G). Arizona. Yuma Co.: near Mohawk, *Peebles & Harrison 5021* (US); Dome to Castle Dome, *Peebles & Kearney 10939* (US). Yavapai Co.: Castle Creek, Bradshaw Mountains, *Toumey 260* (US). Maricopa Co.: Black Cañon Road, 23 miles north of Phoenix, *Gillespie 8665* (US); Camp Creek, *Harrison 1938* (US). Pinal Co.: sandy soil, ½ mile north of Mammoth, *Maguire, Richards & Moeller 10834* (G, I); Oracle, *Newlon 699* (J); near Maricopa, *Peebles, Harrison & Kearney 4909* (US). Pima Co.: Picture Rocks, Tucson Mountains, *Bartram 326* (US); sandy wash-bed, 26 miles east of Tucson, *Maguire, Richards & Moeller 11222* (G, I); Quitovaquito, *Mearns 2746* (US). Santa Cruz Co.: Patagonia and Nogales, *Peebles, Harrison & Kearney 5628* (US); hills between Calabasas and Nogales, *Tidestrom 802* (US). Cochise Co.: Bowie, *Lemmon 283* (G). MEXICO: Lower California: San Marcos Island, *Johnston 3641* (C, G, US); San Luis Gonzales Bay, *Johnston 3331* (C, G, US); near El Marmol, *Wiggins 4364* (G, US); Carmen Island, Nov. 1–7, 1890, *Ed. Palmer 835* (G, US); Cocopa Mountains, *MacDougal 122* (NY); Santa Rosalia, north of flying field, *Ferris 8697* (US); San Felipe, *Goldman 1162* (US); Isla Partida, *Collins, Kearney & Kempton 145* (US). Sonora: Hacienda Oquito (Cutting's Ranch) 6 miles east of Altar, *Wiggins 5967* (US); granitic hills, 5 miles east of Garumbullo, *Wiggins 6125* (US); Bacum Station near Rio Yaqui, *Pennell 20214* (US); 12 miles east of Libertad, *MacDougal & Shreve 48* (US); New Year's Mine, 20 miles south of Hermosillo, *M. E. Jones 22617* (G); 7 miles west of Mina San Jose on road to Misa, *Wiggins 6311* (US). Sinaloa: Topolobampo, *Rose, Standley & Russell 13276* (US). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 442–443. 1936.

Some of the plants of Arizona, particularly *M. E. Jones 24856*, approach the linear-leaved var. *linearifolia*. If, however, the leaf variations here included under var. *typica* were all named little but confusion would result. Some of the plants from the hottest and driest parts of the deserts have very small whitish-tomentose leaves resembling *E. melanadenia* from which the very different seeds distinguish it.

The specimen chosen here as type was left unnamed by Engelmann. Nevertheless, this is taken as type in preference to the

collection of Schott which Engelmann did name, for Schott's specimen lacks seeds and has but few cyathia. Too much weight need not be given the fact that Engelmann did not name the cited sheet of *Wright 1848* in his herbarium for there is another case in which Engelmann failed to name his specimens. Of the three numbers cited by Engelmann as *E. glyptosperma* var. *tenerrima* none was named!

22b. E. PEDICULIFERA Engelm. var. LINEARIFOLIA S. Wats., Proc. Amer. Acad. Arts & Sci. **24:** 76. 1889. TYPE: high mountains, Guaymas, Sonora, Mexico, Sept., 1887, *Ed. Palmer 215* (G!; ISOTYPES C!, US!).—PLATE 664, C, FIGS. 10–11.

Local about Guaymas, Sonora. Additional specimens seen: Guaymas, 1893, *T. S. Brandegee* (C); among rocks at foot of hills, Guaymas, Nov., 1887, *Ed. Palmer 627* (C, F, G, US); San Pedro Bay, *T. Craig 671* (P).

This variety, though extralimital, is included here for completeness since some of the Arizonan plants approach it.

23. EUPHORBIA CINERASCENS Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 186. 1859. TYPE: Bishops Hill near Monterey, Nuevo Leon, Mexico, Feb. 5, 1847, *J. Gregg 215* (M 46715!; photographs G!, W!; ISOTYPE G!, NY!). A satisfactory representative of the species.—*E. melanadenia* Torrey var. *subinappendiculata* Engelm., Proc. Amer. Acad. Arts & Sci. **5:** 172. 1861.[1] Boissier in DC. Prod. **15** (**2**): 32. 1862.—*Chamaesyce cinerascens* (Engelm.) Small, Fl. Se. U. S., 710, 1333. 1903.

Perennial, forming mats up to 50 cm. in diam.; stems to 30 cm. long, prostrate or decumbent, mostly slender (1 mm. diam.), clothed with crisped, short, mostly appressed hairs, internodes up to 2.5 cm. long, average ca. 1 cm.; leaf-blades 2–9 mm. long, ovate with oblique base to oblong with slightly oblique base, usually glabrous above, closely tomentose to glabrate beneath; petioles tomentose, 1–2 mm. long; stipules hairy, ca. 0.5 mm. long, ventral united, linear, dorsal distinct, linear; peduncles less than 1 mm. long, with short appressed hairs; cyathia solitary at the nodes; involucres turbinate, 1.2–1.5 mm. diam., appressed-short-hairy without, glabrous within except below the glands; lobes narrowly deltoid, copiously hairy, equaling the glands; glands transversely oblong, dark reddish-purple; appendages narrow or usually wanting; fifth gland absent; sinus U-shaped, not depressed, densely hairy; bracteoles forming a radial appendage opposite each gland, often united only below, with 5 or 6 very slender short-hairy free segments above; staminate flowers 3–4 per fascicle, 15–20 per cyathium; androphores 1.5–2 mm.

[1] Date according to Trelease & Gray, Bot. Works Geo. Engelmann, 439. 1887.

long, glabrous; gynophore shortly appressed-hairy, exserted and reflexed at maturity; ovary copiously hoary-tomentose, roundly three-lobed; styles parted nearly to the base, 0.5–0.8 mm. long, short-hairy below, clavate; capsule 1.5–1.75 mm. long, ovoid, sharply angled, very short-tomentose; seeds quadrangular 1.2–1.5 mm. long, ca. 0.6–0.9 mm. radially, ca. 0.6–1 mm. tangentially, facets smooth or faintly wrinkled, oblong or often deltoid-oblong radially (i. e. wider below), base obtuse or truncate, apex acutish, coat white, microreticulate.—Plate 663B.

Southwestern Texas, Chihuahua, Coahuila, Nuevo Leon, San Luis Potosi, and Tamaulipas (Map 27). Representative specimens seen: Texas. Brewster Co.: Lechuguilla Flats out of Green Gulch, Chisos Mountains, *Sperry 449* (US); Chisos Mountains, *Mueller 8080* (M, NY, US). Kimble Co.: 5 miles west of Roosevelt, *Cory 21208* (G). MEXICO. Chihuahua: limestone hillside, pass 19 miles east of Jimenez, *Johnston 7851* (G); silty plain 8 miles northwest of Cruces, *Johnston 7987* (G); gravelly benches, pass between Chilicote Station & Las Animas, *Johnston 7997* (G). Coahuila: Juarez on the Sabinas River, 100 miles north of Monclova, Sept., 1880, *Ed. Palmer 1204* (F, G, US); rocky slopes of canyon, 5 miles north of Saucillo, *Johnston 7211* (G); on desert plain, 7 miles south of Hipollito, *Johnston 7240* (G); desert 41 miles west of Saltillo, *Johnston 7694* (G); Municipio de Ramos Arizpe, dry mountain slope east of Hacienda la Rosa, *Wynd & Mueller 37* (G). Nuevo Leon: Monterey, Feb. 17–26, 1880, *Ed. Palmer 1197* (G, US). San Luis Potosi: Estacion de Catorce, Sierra Madre Oriental, gravelly bed of arroyo, *Pennell 17570* (US); Charcas, *Lundell 5196* (US); rocky slopes of a hill, 11 miles south of Matehuala, *Johnston 7577* (G). Tamaulipas: Victoria, May 1–June 13, 1907, *Ed. Palmer 548* (US); Cerro de la Tamaulipeca, near San Miguel, Sierra de San Carlos, *Bartlett 10559* (US). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 439–440. 1936.

24. Euphorbia vallis-mortae (Millsp.) J. T. Howell, Madroño **2:** 19. 1931. Type: a few kilometers north of Indian Wells, between Mohave and Keeler, Kern County, California, June 21, 1891, *Coville & Funston 1008* (US 16203!; fragment F!)—*Chamaesyce vallis-mortae* Millsp., Field Mus. Pub. Bot. **2:** 403. 1916.

Perennial, usually forming a dense rounded plant up to 15 cm. high; herbage hoary-tomentose throughout; stems usually arising from 2–4 cm. below the surface of the ground, this portion brown and glabrous, aërial portion to 1 mm. diam., internodes mostly 1–2.5 cm. long, but much shortened toward the tip, thereby congesting the leaves and cyathia; leaf-blades suborbicular to oblong-ovate, mostly 4–8 mm. long; lower stipules united, filiform, ca. 1 mm. long, densely hairy, upper stipules distinct,

filiform, ca. 0.7 mm. long, densely hairy; cyathia solitary at the nodes; peduncles stout, to 1.5 mm. long, densely hairy; involucres campanulate, ca. 2 mm. diam., densely hairy without, with long erect hairs extending halfway down within opposite glands; lobes with long ascending hairs within, equaling or slightly exceeding the glands, deltoid, entire; glands yellowish or reddish, transversely oblong, to 1 mm. long, the distal slightly shorter; appendages white, as wide as and a little longer than the glands, entire or crenulate, with numerous short hairs beneath and on the margins and a few above; fifth gland absent; sinus U-shaped, with long erect hairs at the bottom; bracteoles mostly united into one group of 6–10 bracteoles opposite each gland, more or less united below, adnate to the involucre, sometimes with shorter bracteoles outside the fascicle, all hairy above; staminate flowers 3–5 per fascicle, 17–22 per involucre; androphores ca. 2 mm. long, slightly exserted, sometimes with a few short hairs above; gynophore densely hairy, long-exserted and reflexed at maturity; ovary three-lobed, densely hairy; styles ca. 0.5 mm. long, parted to the middle, short-hairy below; capsule tomentose, three-angled, 2 mm. long and in diam.; seeds sharply quadrangular, 1.4–1.7 mm. long, ca. 0.7 mm. tangentially and radially, ovate radially, raphe straight, back rounded in tangential silhouette, base obtusely truncate, facets smooth or nearly so, ventral facets concave, dorsal facets slightly convex, coat white, microreticulate.—Plate 663C.

Eastern base of the Sierra Nevada from northwestern Mohave Desert north to Owen's Lake, California (Map 32). Specimens seen: California. Inyo Co.: west shore of Owens Lake, *Hall & Chandler 7323* (C, M, P). Kern Co.: Indian Wells, *Hoffmann 617* (P), *Purpus 5473* (F, G, J, M, US); 6 miles north of Freeman, *Hoffmann 585* (CA, SB); Dove Springs, 1931, *Hoffmann* (SB); Red Rock Canyon, *J. T. Howell 4973* (CA, Peir).

The particular locality-data for the type collection are lacking on the label but are given by Coville, Contr. U. S. Nat. Herb. **4:** 256. 1893.

25. Euphorbia melanadenia Torrey, Rep. Expl. & Surv. Miss. R. to Pacific Ocean **4:** 135. 1857. Type: "Low places near San Gabriel", Los Angeles County, California, 1853–4, *J. M. Bigelow* (NY!; photographs G!, W!; isotype G!). A good representative of the species. Munz, Man. So. Calif. Bot., 289, fig. 153. 1935, good except styles should be 3.—*Anisophyllum melanadenium* (Torr.) Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 23. 1860.—*E. polycarpa* Bentham var. *vestita* S. Wats., Bot. Calif. **2:** 73. 1880.—*Chamaesyce melanadenia* (Torr.) Millsp., Field Mus. Pub. Bot. **2:** 410. 1916.

E. cinerascens Engelm. var. *appendiculata* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**)**:** 186. 1859. Type: San Felipe, San Diego County, California, May, 1852, *Geo. Thurber 628* (M 46715!; isotypes G!, NY!). Differs in no consequential respect.—*E. polycarpa* Bentham var. *appendiculata* (Engelm.) Munz, Bull. So. Calif. Acad. Sci. **31:** 68. 1932.

Chamaesyce aureola Millsp., Field Mus. Pub. Bot. **2:** 406. 1916. Type: Azusa, Los Angeles County, California, alt. 800 feet, May 3, 1912, *H. H. Smith 4933* (F 389282!, photographs G!, W!). A good match for the type of *E. melanadenia*.

E. polycarpa Bentham *sensu* Thurston, Wild Flowers So. Calif., 181, fig. 274. 1936 (photograph).

Perennial from a taproot as much as 5 mm. in diam.; stems ascending or erect, to 20 cm. long, sometimes stout (1.5 mm. diam.) below, closely tomentose, glabrate; leaf-blades 2–9 mm. long, ovate to ovate-lanceolate, base oblique, closely and often hoary tomentose on both surfaces, petioles clothed, as the leaves, 1–2 mm. long; ventral stipules mostly united, linear, hairy, to 1 mm. long, dorsal stipules distinct, linear, hairy, to 1 mm. long; peduncles less than 1 mm. long, with short appressed hairs; cyathia solitary at the nodes; involucres open-campanulate, 1.2–1.5 mm. diam., appressed-short-hairy without, glabrous within except below the glands; lobes narrowly deltoid, copiously hairy, equaling the glands; glands transversely oblong, dark reddish; appendages usually conspicuous, twice as wide as and longer than the glands to rarely wanting, white, margin crenate to subentire, glabrous or rarely with a few short hairs beneath next to the gland; fifth gland absent; sinus U-shaped, not depressed, densely hairy; bracteoles more or less completely united into an upwardly broadening, densely hairy, thickish, radial appendage adnate on the lower half to the involucre opposite each gland; staminate flowers 3–4 per fascicle, 15–20 per cyathium; androphores 1.5–2 mm. long, glabrous or rarely with short hairs above; gynophore shortly appressed-hairy, exserted and reflexed at maturity; ovary copiously hoary-tomentose, roundly three-lobed; styles parted nearly to the base, 0.5–0.8 mm. long, short-hairy below, slender throughout; capsule 1.5–1.7 mm. long, ovoid, sharply angled, very short-tomentose; seeds quadrangular, 1.2–1.5 mm. long, ca. 0.6 mm. radially and tangentially, facets smooth or slightly wrinkled, apex acutish, coat white, microreticulate.—Plate 663A.

Southern California, southern Arizona, northern Baja California including Guadalupe Island, Sonora (Map 12). Representative specimens seen: California. Los Angeles Co.: Verdugo Hills, *Abrams 1381* (NY); rocky slopes, San Gabriel Canyon, San Gabriel Mountains, *L. S. Rose 34521* (M, NY); Mt. Wilson Trail, San Gabriel Mountains, Apr. 5, 1933, *Steele & Pratt* (O);

slopes of Sierra Madre Canyon, San Gabriel Mountains, July 29, 1927, *Hastings* (NY); Lone Hill, near Glendora, *Munz & Eggleston 19622* (G). San Diego Co.: San Felipe Valley in Agave patches, *Reed 5833* (O); Yaqui Wells, Colorado Desert, *Eastwood 2773* (G, NY). Imperial Co.: 1 mile east of Mountain Springs, *Wiegand & Upton 3742* (G). Arizona. Yuma Co.: Mohawk Pass, *Lemmon 296* (G). Yavapai Co.: Copper Basin, *Toumey 251* (NY); on dry mesa, Big Bug, July 21, 1891, *Toumey* (US). Maricopa Co.: Agua Fria, *Coues & Ed. Palmer 264* (M); among the rocks, Canyon Lake, *A. Nelson 11216* (I); road banks along Apache Trail, west end of Canyon Lake, *A. & R. Nelson 1709* (M, NY). Pinal Co.: rocky south slopes, 5 miles west of Superior, *Maguire, Richards & Moeller 10263* (G, I); Oracle Ranger Station, Coronado Forest, *Eggleston 15967* (G, US). Pima Co.: La Osa, *Mearns 2688* (US); Canyon Diablo, Ajo Mountains, *Peebles & Kearney 10836* (US); Santa Catalina Mountains, *Shreve 5154* (G, US); Fresnal, *Thackery 83* (US). Gila Co.: Collom's camp at foot of Matzatzal Mountains, *A. & R. Nelson 1955* (G); Globe, *Kearney & Peebles 12060* (NY); rocky slopes of sandstone, Cassadore Spring Canyon, San Carlos Indian Reservation, *Maguire, Richards & Moeller 10301* (I); Collom Camp, Matzatzal Mountains, *Collom 33* (M, NY, US). Navajo Co.: Fort Apache, 1892, *Hoyt* (NY). Graham Co.: rocky soil, 12 miles east of Coolidge Dam, US Highway 180, *Maguire, Richards & Moeller 13024* (G, I). Cochise Co.: Pinery Creek, Chiricahua Mountains, Aug., 1896, *Fernow* (US). MEXICO. Baja California: sandy wash at junction of El Marmol and San Fernando Roads, 25 miles from El Marmol, *Wiggins 4357* (G, US); Lagoon Head, Mar. 6–15, 1889, *Ed. Palmer 783* (G, NY); near San Quentin Bay, *Orcutt 2196* (M); Jacumba, *Fisher 39* (US). Sonora: granitic hills 2 miles south of Sasabe, *Wiggins 5915* (US). For citation of additional specimens see Bull. Torr. Bot. Club. **63:** 438–9. 1936.

Jepson, Man. Fl. Pl. Calif., 600. 1925[1] includes under *Euphorbia polycarpa* var. *vestita* three entities, judging by the range given: *E. melanadenia* "Santa Monica; Glendora; Cahuenga Pass"; *E. polycarpa* var. *hirtella*, at least in part, "Colorado Desert"; *E. vallis-mortae*, "Inyo Co.". However, Jepson, Fl. Calif. **2:** 429. 1936, has the entities correctly delimited and named except that the proof of the statement that *E. melanadenia* occurs in "western Nevada" has yet to be supplied. I find neither explanation nor support for it in the *Euphorbiae* of Jepson's herbarium which he so kindly loaned to the Gray Herbarium for my use.

[1] Title-page date questionable but here accepted as no question of priority is involved.

That the type of *E. melanadenia* did not come from "Low places near San Gabriel" is highly probable since this plant is confined to a narrow zone on the foot of the mountains in this region. Probably Bigelow collected it in the vicinity of Sierra Madre.

26. Euphorbia polycarpa Bentham, Bot. Voy. Sulphur, 50. 1844.

Perennial from a taproot slender or up to 6 mm. diam., prostrate or erect, sometimes forming a low rounded bush as much as 25 cm. high; stems very slender throughout or as much as 4 mm. diam. at base, sometimes zigzag, glabrous or with short spreading hairs, internodes mostly 1–2 cm. long, often much shorter upward; leaves glabrous or more or less pubescent, blades 1–10 mm. long, more or less oblique at base, orbicular to oblong-lanceolate, thin to thick, petioles clothed as the blades, 1–2 mm. long; ventral stipules united, ca. 0.5 mm. long, deltoid or rounded, ciliate or glabrous, dorsal stipules distinct, narrowly deltoid, ca. 0.5 mm. long, ciliate or sometimes glabrous; peduncles to 2 mm. long, glabrous or with short spreading hairs; involucres solitary at the nodes, distributed along the stem or more or less congested at the branch-tips, campanulate, 1–1.5 mm. in diam., glabrous or with short spreading hairs without, glabrous within except immediately below the glands, lobes narrowly deltoid to deltoid-attenuate, equaling or slightly exceeding the glands, short-hairy; glands maroon, transversely oblong, 0.5–0.75 mm. long; appendages up to three times as wide as the glands to absent, as long as or longer than the gland, white or reddish, entire or crenate, glabrous or with a few short hairs below on inner portion; fifth gland absent, its sinus U-shaped and not depressed, or V-shaped and slightly depressed; bracteoles forming a radial appendage opposite each gland, united to the involucre on lower half, linear, tapering upward, entire, or broader, with 2–5 divisions above, short-hairy above; staminate flowers 15–32 per cyathium; androphores 1–1.5 mm. long, glabrous or rarely short-hairy above; gynophore glabrous or short-hairy above, exserted and reflexed at maturity; ovary glabrous or densely pubescent, three-lobed; style bifid, 0.3–0.5 mm. long, glabrous or short-hairy below, clavate or slender above; capsule sharply 3-angled, glabrous or pubescent, spheroid, 1.1–1.3 mm. diam.; seeds quadrangular, 1–1.3 mm. long, ovate in radial outline, 0.5–0.6 mm. radially and tangentially, apex acutish, base truncate or obtuse, angles sharp, back curved, raphe straight, micropylar area slightly truncated, facets smooth or slightly wrinkled, plane or concave, the back facets lower than the angles, i. e., slightly depressed, coat micro-reticulate, white, opaque, or so thin that the brown testa shows through.

KEY TO VARIETIES

Appendages present, petioles ca. 1/4 as long as leaves.
  Appendages wide to narrow and herbage usually essentially glabrous . . . . a. var. *typica*.
  Appendages narrow and herbage pubescent . . . . b. var. *hirtella*.
Appendages absent, petioles ca. 1/2 as long as leaves . . . . c. var. *simulans*.

26a. E. POLYCARPA Bentham, Bot. Voy. Sulphur, 50. 1844, var. TYPICA L. C. Wheeler, Bull. Torr. Bot. Club **63:** 408. 1936. TYPE: Bay of Magdalena, Lower California, Mexico, 1841, *Hines* (K!; photographs G!, W!; fragment F!). Boissier in DC. Prod. **15** (**2**): 44. 1862; Jepson, Man. Fl. Pl. Calif., 600, fig. 593. 1925;—*Chamaesyce polycarpa* (Benth.) Millsp. ex Parish, Cat. Pl. Salton Sink, 6. 1913 (preprint from Carn. Inst. Wash. Pub. **193:** 110. 1914.)—PLATE 657D.

California and Nevada, south to Lower California and Sonora (MAP 4). Representative specimens seen: CALIFORNIA. Los Angeles Co.: Eagle Rock foothills, *Rockwell 300* (J). San Bernardino Co.: the Needles, *M. E. Jones 5178* (I, O); Dunes, Needles, *Parish 9608* (G, M). Riverside Co.: Elsinore, Apr. 1892, *McClatchie* (NY); slopes of Box Springs Mountains, Riverside, Nov. 12, 1919, *Barrus 7* (O); between Cottonwood Mountains and Mecca, *McKelvey 5038* (G); near Desert Center, *M. E. Jones 24860* (G). San Diego Co.: San Diego, *Brandegee 615* (G, NY); Sweetwater valley, Apr. 30, 1883, *G. C. Deane* (G); Yaqui Wells, Colorado Desert, *Eastwood 2766* (G); near Sentenac Canyon, *Jepson 12475* (J); Escondido, *Meyer 230* (J); Del Mar grade from La Jolla, *Newlon 312* (J). NEVADA: 8 miles above Rioville, *M. E. Jones 5035* (M); Virgin River, *Goodding 708* (G). ARIZONA. Yavapai Co.: Castle Creek, *Toumey 263* (US). Yuma Co.: east of Blythe, *M. E. Jones 24877* (G, NY); Quartzsite, *M. E. Jones 24878* (G, NY); near Quartzsite, Sept. 20, 1934, *Kearney & Peebles* (US); Yuma, Apr. 21, 1913, *Wooton* (US). Maricopa Co.: Phoenix, June 20, 1891, *Dewey* (US); near Tempe, *Gillespie 8415* (US); Black Canyon Road, 23 miles north of Phoenix, *Gillespie 8666* (US); Hyder, *Peebles 6420* (US); near Phoenix, *Peebles, Harrison & Kearney 2461* (US); 5 miles east of Gila Bend, *Wolf 2300* (G). Pima Co.: north of mouth of Sabino Canyon, *Shreve 5354* (US); foothills of Santa Catalina Mountains, Apr. 8, 1884, *Pringle* (US). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 408. 1936.

26b. E. POLYCARPA Bentham var. HIRTELLA Boiss. in DC. Prod. **15** (**2**): 44. 1862. TYPE: California, *Emory* (Ge; fragment F!)—*Chamaesyce polycarpa* var. *hirtella* (Boiss.) Millsp. ex Parish, Cat. Pl. Salton Sink, 6. 1913 (preprint from Carn. Inst. Wash. Pub. **193:** 110. 1914)—*C. tonsita* Millsp., Field Mus. Pub. Bot. **2:** 412. 1916.

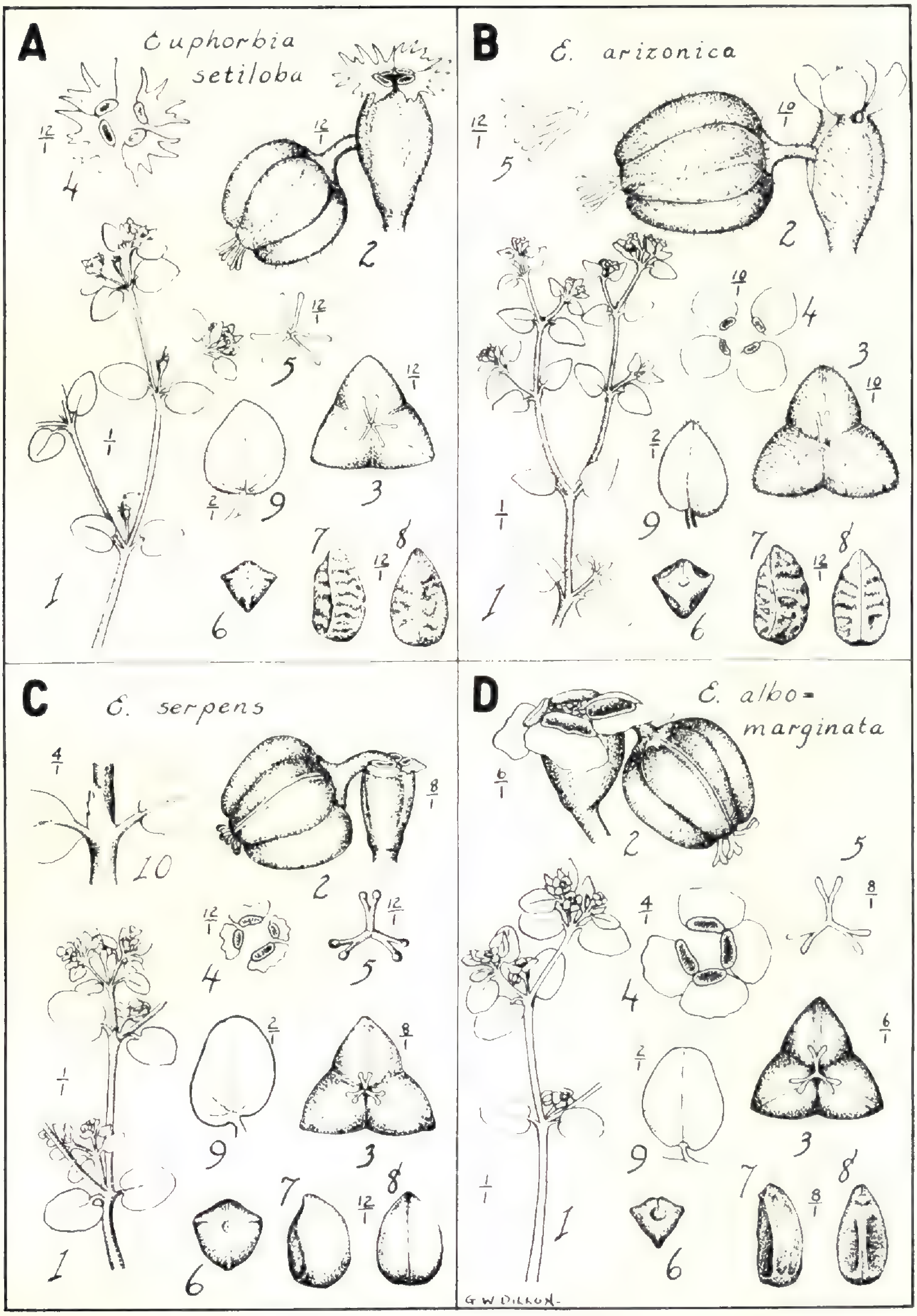
Deserts of California and southern Nevada, south to lower

California and Sonora (Map 3). Representative specimens seen: California. San Bernardino Co.: Soda Lake Mountains near Baker road station, May 30, 1931, *Beal* (J); Twenty-nine Palms, Colorado Desert, *Jepson 5964* (J). Riverside Co.: Devil's Canyon, Santa Rosa Mountains, Coachella Valley, *Clary 655* (J); Palm Canyon and return to Van Deventer's, *Jepson 1374* (J); Palm Springs, Colorado Desert, Apr. 18, 1921, *Spencer* (O); Palm Canyon, *Johnston 1050* (US); mouth of Palm Canyon, Borego Valley, *Duran 3176* (G, I, O); Signal Mountain, Colorado Desert, *Abrams 3187* (G). Imperial Co.: upper end of Painted Gorge, Carisso Mountains, *Ferris & Rossbach 9605* (G). Nevada: the Muddy Range, *Goodding 2222* (G). Yuma Co.: Yuma, Feb., 1881, *Vasey* (US); Yuma, Nov. 6, 1909, *Mowry* (US); Aztec, *Harrison 3563* (US). A collection differing in having the appendages almost twice as wide as the glands and deeply parted into several segments is possibly worth varietal recognition but is tentatively referred here until seeds, which were lacking, can be had: in rock crevices, Orocopia Mts. south of Hayfield's Reservoir, Riverside Co., California, alt. 1400 ft., Dec. 3, 1939, *Jaeger* (W).

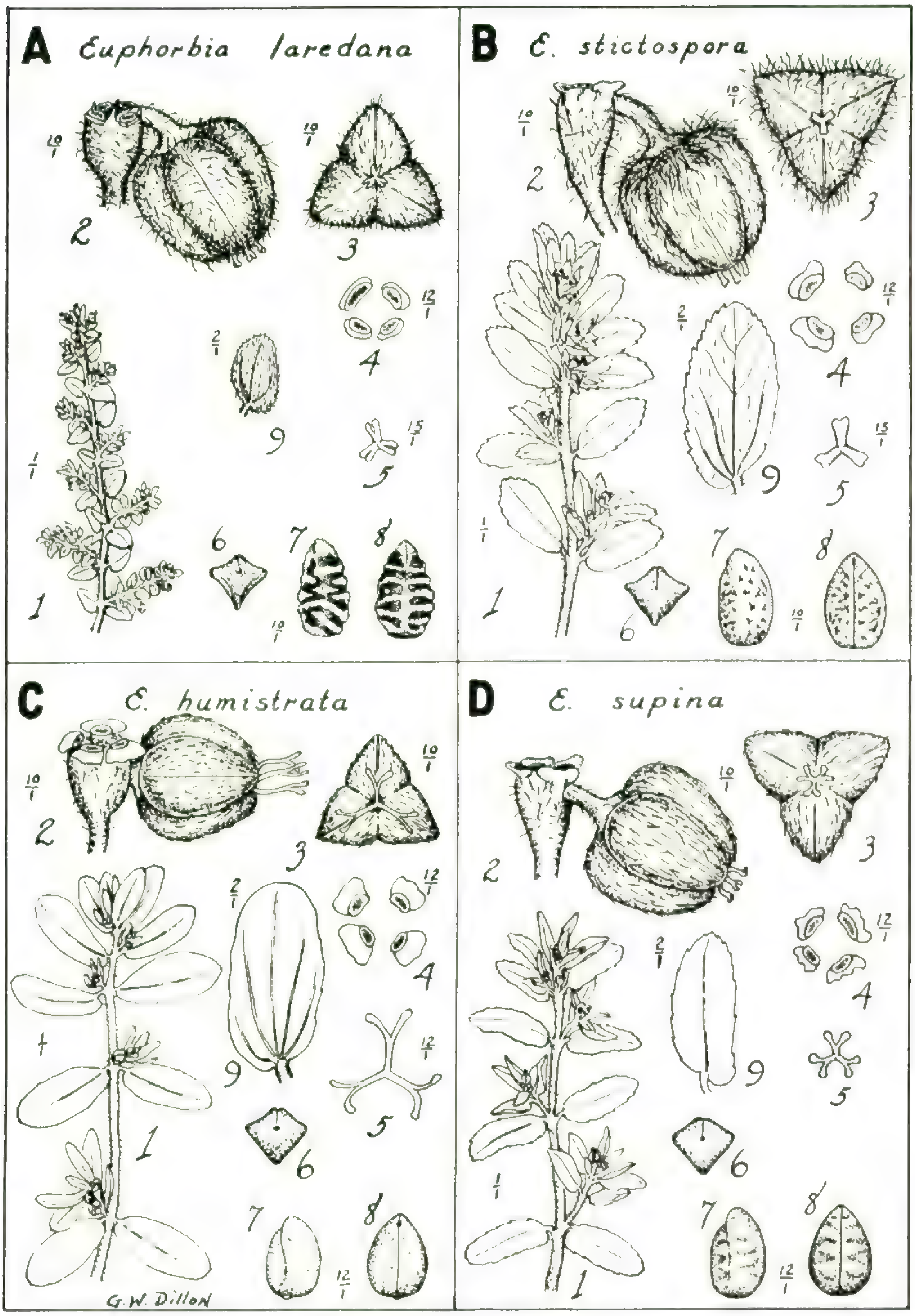
26c. E. polycarpa Bentham var. **simulans** var. nov. Glabra; petiolus limbo ca. duplo brevior; glandulae exappendiculatae.

Type: dry hillside near the Rio Grande, mouth of Santa Helena Canyon, Big Bend State Park, Brewster County, Texas, alt. 2,100 feet, Sept. 6, 1938, *Rollins & Chambers 2770* (G!). Additional specimens seen: Texas. Brewster Co.: frequent in stream-bed 2 miles east of Castolon, Mar. 4, 1937, *Cutler 723* (G); Castolon, May 5, 1928, *Cory 1927* (G); Santa Helena Canyon, Oct. 21, 1937, *Cory 26452* (G); common, sandy soil in valleys, Boquillas, Aug. 3, 1919, *Hanson 714* (G, US); mouth of Santa Helena Canyon, Aug. 8, 1938, *Warnock C506*, in part (US); near Chisos Mountains, *Young 139* (M); between Goat and Trap Mountains, *E. J. Palmer 34207* (NY); near San Vincente, *Sperry 1358* (US); Santa Helena Canyon, June 7, 1937, *Warnock 985* (US). Presidio Co.: Presidio, Sept. 27, 1937, *Warnock T95* (US). (Map 5).

27. Euphorbia Parishii Greene, Bull. Calif. Acad. **2:** 56. 1886. Type: Warm Springs, Mohave Desert, San Bernardino County, California, May, 1882, *S. B. & W. F. Parish 1384* (probably lost when the herbarium of California Academy burned in 1906, for Dr. Theodor Just states in letter of Feb. 25, 1939, filed at Gray Herbarium, that there is only a fragment in Herbarium Greeneanum at Notre Dame University; isotypes D!, M!, NY!).—*Chamaesyce Parishii* (Greene) Millsp. ex Parish, Cat. Pl. Salton Sink, 6. 1913, preprint from Carn. Inst. Wash. Pub. **193:** 110. 1914.—*E. polycarpa* Bentham var. *Parishii* (Greene) Jepson, Fl. Calif. **2:** 429. 1936.



WHEELER on EUPHORBIA



WHEELER on EUPHORBIA

· *E. patellifera* J. T. Howell, Leafl. West. Bot. **1:** 53. 1933. TYPE: Palm Wash, western Colorado Desert, San Diego County, California, *J. T. Howell 3488* (CA!; ISOTYPE F!).

Perennial, forming prostrate mats 20–50 cm. across, or a low bush 15–20 cm. high; stems slightly woody below in age, slender, glabrous, internodes 5–15 mm. long; leaf-blades mostly ovate, 2–4 mm. long, entire, glabrous, or very rarely tomentulose beneath, base oblique, apex mucronulate, midrib evident at least in lower half of blade; petioles 0.5–1 mm. long, glabrous, amplexicaul on ventral side of stem; upper stipules distinct, mostly entire, ciliate, broadly linear, 1 mm. long, lower stipules often more or less united, ciliate, linear, 1 mm. long; peduncles up to 1 mm. long, glabrous; cyathia solitary at the nodes; involucre campanulate, tapering to the peduncle, 1–1.2 mm. diam., glabrous without, with many short hairs within above; lobes broadly deltoid, mostly dentate, ciliate on inner face, equaling the glands; glands discoid, ca. 0.5 mm. diam., pale yellow or reddish, on stipes ca. half as wide as the gland; stipes ciliate on inner side; appendages absent; fifth gland ciliate on inner side, linear, mostly shorter than the lobes; sinus U-shaped, not depressed; bracteoles united for half their length, forming a membranous radial appendage ca. 1.3 mm. long, adnate for half its length to the involucre opposite each gland, glabrous below, ciliate above; staminate flowers 8–10 per fascicle, 40–50 per involucre; androphores glabrous, ca. 1.5 mm. long, slightly exserted at maturity; gynophore glabrous, long-exserted and usually reflexed at maturity; ovary glabrous, three-angled; styles ca. 0.5 mm. long, bifid to the middle, glabrous; capsule glabrous, sharply three-angled, oblate-spheroid, ca. 1.75 mm. long; seeds ca. 1.5 mm. long, ca. 0.75 mm. tangentially, ca. 0.65 mm. radially, quadrangular, long-ovate in radial outline, raphe straight, slightly truncated above, back sharply angled, facets faintly wrinkled, coat white, microreticulate.—PLATE 658B.

Deserts of Inyo, Kern, San Bernardino, Riverside, and San Diego Counties, California, east to Nevada (MAP 25). Representative specimens seen: CALIFORNIA. Inyo Co.: Furnace Creek Ranch, Death Valley, Apr. 30, 1917, alt. to 100 ft., *W. L. Jepson* (J); Stove Pipe Wells, Death Valley, *P. A. Munz & C. L. Hitchcock 11032* (P); near Triangle Spring, Death Valley, growing in dense brown mats on pebbly wash-fan, Apr. 17, 1917, *J. Grinnell* (J); Surprise Canyon, *S. B. Parish 10217* (C, J); Emigrant Canyon, Panamint Mountains, *R. S. Ferris, F. M. Scott & R. Bacigalupi 3998* (D); Emigrant Springs, *S. B. Parish 10190* (C, J); Greenwater Flat, *S. B. Parish 10138* (C). San Bernardino Co.: Baxter, Mohave Desert, *S. B. Parish 9882* (C); Ludlow, Mohave Desert, 1926, *M. E. Jones* (P). NEVADA. Lincoln Co.: Muddy Valley, alt. 1,700 ft., *Kennedy & Goodding 77* (NY, US).

For citation of additional specimens see Bull. Torr. Bot. Club **63:** 406. 1936.

28. Euphorbia micromera Boiss. ex Engelm., Proc. Amer. Acad. Arts & Sci. **5:** 171. 1861; Boiss. in DC. Prod. **15** (**2**)**:** 44. 1862. Type: bed of a creek descending to the San Pedro River, Cochise County, Arizona, Sept. 8, 1851, *C. Wright 1854* (M 149918!; photographs G!, W!, isotypes F!, G!, Ge!). Small and essentially glabrous, a good representative of the species.—*E. polycarpa* Bentham var. *micromera* Millsp. ex Orcutt, West Amer. Scientist **10:** 134. 1901; with neither basinym nor description, identity inferred from the coincidence of names.—*Chamaesyce micromera* (Boiss.) Wooton & Standley, Contr. U. S. Nat. Herb. **16:** 144. 1913.

E. pseudoserpyllifolia Millsp., Pittonia **2:** 87. 1890. Type: Bowie, Cochise County, Arizona, Sept. 15, 1884, *M. E. Jones 4223* (F 196599!; photographs G!, W!, isotypes G!, I!, P!, US!). Differing little from the type of *E. micromera* which was not considered.—*Chamaesyce pseudoserpyllifolia* (Millsp.) Millsp., Field Mus. Pub. Bot. **2:** 411. 1916.—*E. pseudoserpyllifolia* Millsp. forma *typica* J. T. Howell, Leafl. West. Bot. **1:** 52. 1933.

E. podagrica I. M. Johnston, Univ. Calif. Pub. Bot. **7:** 440. 1922. Type: washes at Gold Mountain, Esmeralda County, Nevada, 1898, *C. A. Purpus 6437* in part (C 110920!). Differing in no essential respect from the type of *E. micromera* which was not considered.

E. pseudoserpyllifolia Millsp. forma *villosa* J. T. Howell, Leafl. West. Bot. **1:** 53. 1933. Type: south of Palm Springs near Cathedral City, Riverside County, California, *J. T. Howell 6651* (CA 188849!). Differs from the type only in vestiture which is too variable to warrant recognition.

E. setiloba Engelm. var. *nodulosa* Jepson, Fl. Calif. **2:** 427. 1936. Type: between Brawley and Salton Sea, Colorado Desert, Imperial County, California, Oct. 15, 1912, 115 feet below sea level, *S. B. Parish 8301* (J!; photographs G!, W!; isotypes D!, F!, G!). This is the nodulose vestite variant local in the Colorado Desert. Some of the glands bear minute appendages. Possibly with more numerous collections this variant may prove itself worthy of recognition.

Prostrate annual: stems glabrous or pubescent, extremely variable, one extreme very straight, thick, with thickened nodes and internodes up to 1 cm. long, the other extreme flexuous or straightish, slender, nodes not thickened, internodes up to 2 cm. long; leaves glabrous or short-pubescent, blades 2–7 mm. long, ovate and base markedly oblique in the larger, oblong and base slightly oblique in the smaller, petioles ca. 0.5 mm. long; stipules ca. 0.7 mm. long, or shorter in pubescent plants, triangular, ciliate, upper distinct, lower often united toward stem-tip;

peduncles glabrous or pubescent, up to 1 mm. long; cyathia solitary in the axils; involucres ca. 0.9 mm. in diam., very short-campanulate, narrowed above, more or less cuneate to the peduncle, glabrous or pubescent without, glabrous within except the lobes, green-veined beneath the lobes; lobes deltoid, equaling or slightly exceeding the glands, hairy within; glands pink or red, strictly discoid or transversely oblong, especially the proximal, 0.1–0.15 mm. diam.; appendages absent or, in some pubescent and nodulose plants occasionally present as minute white margins; fifth gland absent; sinus broadly V-shaped, hairy, little depressed; bracteoles reduced to a solitary linear hairy appendage ca. 0.5 mm. long, adnate for most of its length to the involucre opposite the glands; staminate flowers 2–5 per involucre; androphores glabrous, included, 0.7–0.9 mm. long; gynophore glabrous throughout or short-hairy above, long-exserted and usually reflexed at maturity; ovary three-angled, glabrous to pubescent, carpels slightly grooved on the back; styles bifid, glabrous, ca. 0.2–0.3 mm. long, clavate; capsule three-angled, glabrous to pubescent, spheroid, ca. 1.3 mm. long; seeds quadrangular, 1.1–1.3 mm. long, 0.5 mm. tangentially, 0.4 mm. radially, narrowly ovate radially, angles sharp, facets smooth or with very faint wrinkles, convex, especially the front, base truncate, raphe straight or slightly concave, shortly truncate at a slight angle above, microreticulate white coat thin, with the brown of the testa showing through.—PLATE 658C.

Deserts from Inyo County south to Imperial County, California; Esmeralda and Clark Counties, Nevada; San Juan County, Utah; Arizona; Grant and Doña Ana Counties, New Mexico; Reeves and Brewster Counties, Texas; Chihuahua; and Coahuila and Peru (MAP 26). Representative specimens seen: CALIFORNIA. San Bernardino Co.: Daggett, Mohave Desert, Oct. 13, 1933, *Beal* (J). NEVADA: Clark Co.: near Boulder City, *Eastwood & Howell 6292* (G). UTAH: San Juan Co.: along San Juan River near Bluff, *Rydberg & Garrett 9896* (NY). ARIZONA: Yuma Co.: south of Quartzsite, *Kearney & Peebles 10219* (US); Mohawk, *Peebles, Harrison & Kearney 4976* (US). Pinal Co.: Sacaton, *Peebles 5000* (US). Pima Co.: Wilmot, on range reserve, *Thornber 341* (US). Gila Co.: Sierra Ancha, *Harrison & Kearney 8293* (US). Navajo Co.: Holbrook, Oct. 4, 1879, *Zuck* (NY, US in part). NEW MEXICO: Grant Co., gravel beds of the Gila River, *E. L. Greene 266* (M). Doña Ana Co.: Mesilla Valley, Oct. 5, 1899, *Wooton* (NY). TEXAS: Reeves Co.: *Cory 1959* (G). Brewster Co.: Persimmon Gap area, *Sperry 1464* (US). MEXICO: CHIHUAHUA: 3 miles north of Charco Piedra, *Johnston 7925* (G). COAHUILA: 3 miles south of Peña, *Johnston 7729* (G). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 432–433. 1936.

This species is nowhere abundant and, while wide-ranging, occupies only scattered stations. Formerly, l. c., I included *Orcutt 1331* from Socorro, northern Baja California here. That collection, the basis of the *nomen nudum, Euphorbia baja californica* Millsp. ex Orcutt, West Amer. Scientist **10:** 134. 1901, differs in having styles ca. 0.6 mm. long and scarcely clavate; involucres ca. 1.1 mm. in diam.; staminate flowers 7–8; seeds strongly and irregularly ridged and glands often appendaged. (The specimen which is the type, if nomina nuda are worth typifying, is F 197073! for this came from Millspaugh's herbarium and is labeled "E. Baja-Californica sp. nov." There was some mistake made since the plants on the sheet are *E. cordifolia;* only the fragments in the pocket are the Lower Californian plant. Probably a mixture occurred during mounting.) This entity may be only worth varietal recognition, but, being extra-limital, is excluded here. Likewise *Ed. Palmer 789* (US), Baja California, Lagoon Head, is excluded as it seems to be the same as *Orcutt 1331*.

The reason that the specimen at M rather than the specimen at Ge is taken as type is that in the loan from Ge there is included only the merest fragment which is mislabeled as "*Fendler no. 1854*" when it should have been "*Wright no. 1854*". Furthermore the label accompanying this fragment bears no name. The piece sent may be a portion of Boissier's specimen but that is not certainly known. In view of the fact that Engelmann published the species first, attributing it to Boissier, and left a good specimen with a label bearing the name of the plant, it seems justifiable to take Engelmann's specimen as type.

The following new example of common identities between North and South America is to be noted: Shale cliff above sea, alt. 0–20 m., Paita, Dept. Piura, Peru, July 4, 1925, *F. W. Pennell 14815* (G).

29. Euphorbia cordifolia Elliott, Sketch Bot. So.-Car. & Georgia **2:** 656. 1824.[1] Type: "Grows in cultivated land, common around Beaufort [South Carolina] in dry soils." (Charleston, South Carolina, Museum).—*Chamaesyce cordifolia* (Ell.) Small, Fl. Se. U. S., 709, 1333. 1903.

Annual, glabrous; stems prostrate, or occasionally ascending in small plants, 4–35 cm. long, 0.5–2 mm. thick, internodes

[1] See J. H. Barnhart, Dates of Elliott's Sketch, Bull. Torr. Bot. Club **28:** 680–688. 1901.

rarely up to 6 cm. long, mostly 2 cm. long or shorter; leaf-blades elliptic-orbicular to oblong and ovate-oblong, 4–12 mm. long, base more or less inequilateral, often cordate, margin entire; petioles ca. 1 mm. long; stipules parted to the base into few to several filiform segments up to 1.4 mm. long, mostly with short scattered hairs at least when young, dorsal distinct, ventral often united; peduncles 0.4–4 mm. long; cyathia solitary at the nodes and at the branch-tips but often congested by the marked shortening of the upper internodes; involucre broadly campanulate, 1.3–1.6 mm. in diam., glabrous outside, glabrous inside except at the base of the lobes and beneath the glands; lobes subulate, pubescent below, glabrous above, slightly exceeding the glands; glands transversely elliptical to oblong, often strongly folded, 0.5–0.9 mm. long; appendages from 1–3 times as wide as the gland, to 1.3 mm. wide, the wider radially broadly elliptical to reniform, glabrous, entire or with two or three low blunt teeth; fifth gland consisting of 1 or 2 linear filiform segments, glabrous above, equaling the lobes; sinus U-shaped, not depressed; bracteoles mostly united into a radial partition adnate for ca. half its length to the involucre, free portion parted into few to several linear pubescent segments, a few of the bracteoles entirely free; staminate flowers 9–44 per cyathium; androphores 1.2–1.6 mm. long, glabrous, or occasionally with a few short hairs above; gynophore glabrous or rarely pubescent below, exserted and reflexed; ovary glabrous, 3-angled; styles parted to the base, 0.6–0.9 mm. long; capsule glabrous, sharply 3-angled, wider below the equator, 1.7–2.1 mm. long; seeds ovoid-triangular, 1.2–1.5 mm. long, 0.7–0.9 mm. tangentially and radially, radially ovate to oblong-ovate, usually acute, or with low faint wrinkles, slightly concave to slightly convex, angles blunt, coat white, microreticulate, mostly so thin as to little obscure the pale, brown to gray testa.—PLATE 658A.

Mostly in sandy pine barrens, North Carolina to Florida, west to Texas (MAP 30). Representative specimens seen: NORTH CAROLINA. Pender Co.: Point Rock, Aug. ?, *Williamson* (NY). SOUTH CAROLINA: "Sand hills of S. C.". Oct. ?, *Ravenel* (G). GEORGIA. Richmond Co.: Augusta, Aug., 1902, *Anon.* (NY). Macon Co.: on site of Andersonville stockade, Sept. 5, 1897, *Harper* (NY). Dooly Co.: near Flint River, *Harper 574* (G, NY). Dougherty Co.: Albany, *Tracy 4710* (NY); pine barrens bordering the Altamaha River, *Curtiss 2469* (G, NY). FLORIDA. Lake Co.: near Eustis, *Nash 1070* (G, NY). Orange Co.: 1894. *Lewton* (NY). Polk Co.: Haines City, *Curtiss 5959* (G, NY). Hillsborough Co.: west coast, 1886, *Curtiss* (G). Walton Co.: summer, 1885, *Curtiss* (NY). Escambia Co., *Biltmore Herb. 5895*[b] (NY). Suwanee Co.: 5 miles west of Live Oak, *Wiegand & Manning 1801* (G). Gilchrist Co.: Hammock

along the Suwanee River east of Old Town, *J. K. Small, J. W. Small & DeWinkeler 11470* (NY). Mississippi. Jackson Co.: Horn Island, *Tracy 6370* (NY). Harrison Co.: Cat Island, *F. E. Lloyd & Tracy 208* (G, NY). Louisiana. Rapides Co.: Alexandria, *Hale* (NY). Texas. Tarrant Co.: in field, *Ruth 686* (NY). Medina Co.: 30 miles west of San Antonio, Sept., 1879, *Ed. Palmer 1212* (G). Hays Co.: San Marcos, *Stanfield* (NY). Colorado Co.: 6 miles northeast of Alleyton, *Cory 25096* (G). Walker Co.: near Huntsville, *Dixon 335* (G, NY). Waller Co.: Hempstead, *Hall 547* (G, NY). Jefferson Co.: Sabine Pass, July, 1884, *Neally* (G). Nueces Co.: near Corpus Christi, Mar., 1894, *Heller* (NY).

The type was recently examined by Professor Fernald who reports that it is identical with the usual interpretation of the species as exemplified by the two following collections from Georgia with which he compared it: *A. H. Curtiss 2469* (G); *R. M. Harper 574* (G).

There are two races of this species. This was discovered by the counts of the staminate flowers. In ten collections from west of the Mississippi River the number of staminate flowers per cyathium was 29–44; in ten collections from east of the Mississippi River the number per cyathium was 9–27. Having made this discovery a reexamination of the collections from these two areas was made in order to ascertain whether there were any more obvious differences between the two races. While there is a tendency in the eastern plants to have smaller leaves and shorter internodes there are too many exceptions to make any practical or certain division on these characters. Examination of a more ample suite of specimens would very likely produce intermediate numbers of staminate flowers. Since the species forms an acceptable unit as an undivided aggregate no attempt will be made here to further distinguish the two races.

Boissier in DC. Prod. **15** (**2**)**:** 30. 1862 identifies *Euphorbia ludoviciana* Raf., Fl. Ludovic., 111. 1817, with *E. cordifolia.* Since Rafinesque described his species as having leaves other than entire this identification must be erroneous.

30. Euphorbia serpens HBK., Nov. Gen. et Sp. **2:** 52 (quarto), 41 (folio). 1817.[1] Type: Cumana, Venezuela, *Bonpland 407* (Herb. Mus. Paris; photograph G! fragment F!).

[1] See Barnhart, Bull. Torr. Bot. Club **29**: 585. 1902 as to date and for discussion of the quarto and folio editions.

Average as to habit and leaf-size, nodes rooting. Boissier in DC. Prod. **15** (**2**)**:** 29. 1862; Millsp., Bot. Gaz. **25:** 18. 1898, fifth gland broken in figure; Thellung, Bull. Herb. Boiss. ser. 2, **7:** 755. 1907; N. E. Brown in Thiselton-Dyer, Fl. Trop. Afr. **6** (**1**)**:** 511. 1911; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 440–443. 1917; L. C. Wheeler, Bull. So. Calif. Acad. Sci. **33:** 108. 1934.—*Anisophyllum serpens* (HBK.) Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 23. 1860.—*E. radicans* Moricand ex Klotzsch & Garcke, op. cit., 24, as synonym of *Anisophyllum serpens.*—*Chamaesyce serpens* (HBK.) Small, Fl. Se. U. S., 709, 1333. 1903.—*E. serpens* HBK. A *genuina* Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 442. 1917.

E. herniaroides Nutt., Trans. Amer. Philos. Soc. n. s. **5:** 171. 1837. TYPE: Arkansas, probably *Nuttall* (PH!, or perhaps isotype?; photographs G!, W!).

E. flexicaulis Scheele, Linnaea **22:** 153. 1849. TYPE: "nordlich von Neubraunfels: Lindheimer. August." Comal County, Texas (?). Description places it here.—*E. serpens* HBK. var. *flexicaulis* (Scheele) Coulter, Contr. U. S. Nat. Herb. **2:** 388. 1894 (the available *E. serpens* var. *radicans* cited in synonymy). —*E. serpens* A *genuina* III *flexicaulis* (Scheele) Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 442. 1917.

E. serpens var. *radicans* Engelm. ex Boiss. in DC. Prod. **15** (**2**)**:** 30. 1862. TYPE: Tampico, Mexico, *Berlandier 140* (Ge!; photographs G!, W!; ISOTYPE US 1169354!). Merely a vegetational phase with roots at some of the nodes.—*E. radicans* Moricand ex Boiss., l. c., as synonym of above name.—*Chamaesyce radicans* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 411. 1916.

E. serpens var. *imbricata* Boiss. in DC. Prod. **15** (**2**)**:** 30. 1862. TYPE: Texas, *F. Lindheimer 693* (Ge!; photographs G!, W!). Internodes short and leaves thick, presumably due to a dry habitat. (This is the *Chamaesyce Hartwegiana* (Boiss.) Small *sensu* Small, Fl. Se. U. S. ed. 2, 1349. 1913).—*E.* "*herniaroides* Nutt. var. *imbricata*" Engelm. ex Blankinship, Ann. Rep. Mo. Bot. Gard. **18:** 149. 1907, as synonym of *E. serpens* HBK.; indexed in op. cit., **20:** 183. 1909. *E. serpens* A *genuina* II *imbricata* (Boiss.) Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 442. 1917.

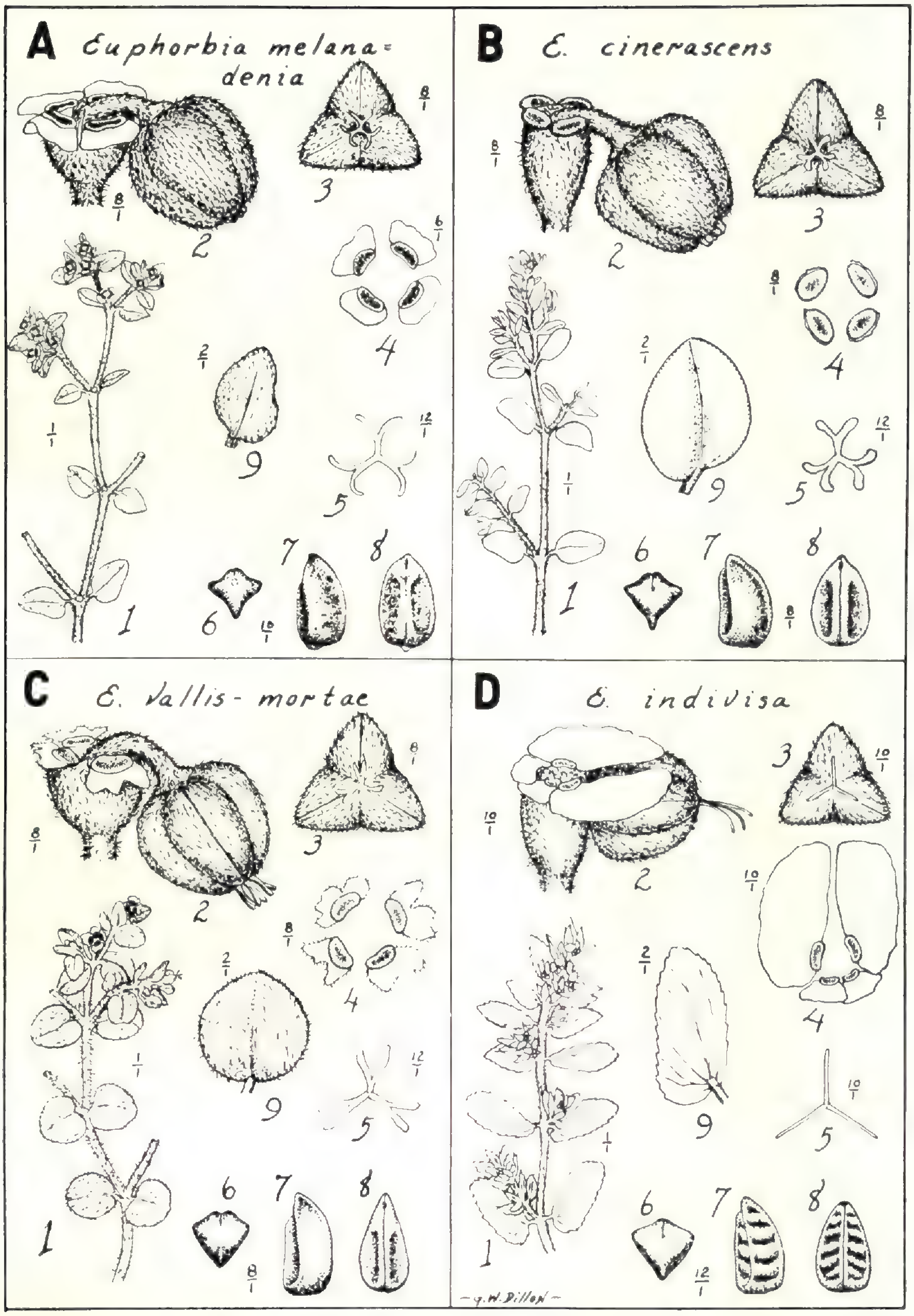
E. serpens A *genuina* III *flexicaulis* b *psilocyathia* Thellung, l. c. TYPE: Illinois (Zurich?). Referred here from the description.

E. forbuserpens HBK. ex Wood & McCarthy, Journ. Elisha Mitchell Soc. **1885–6:** 119. 1886 (without description) is doubtless a *lapsus calami* for *E. serpens.*

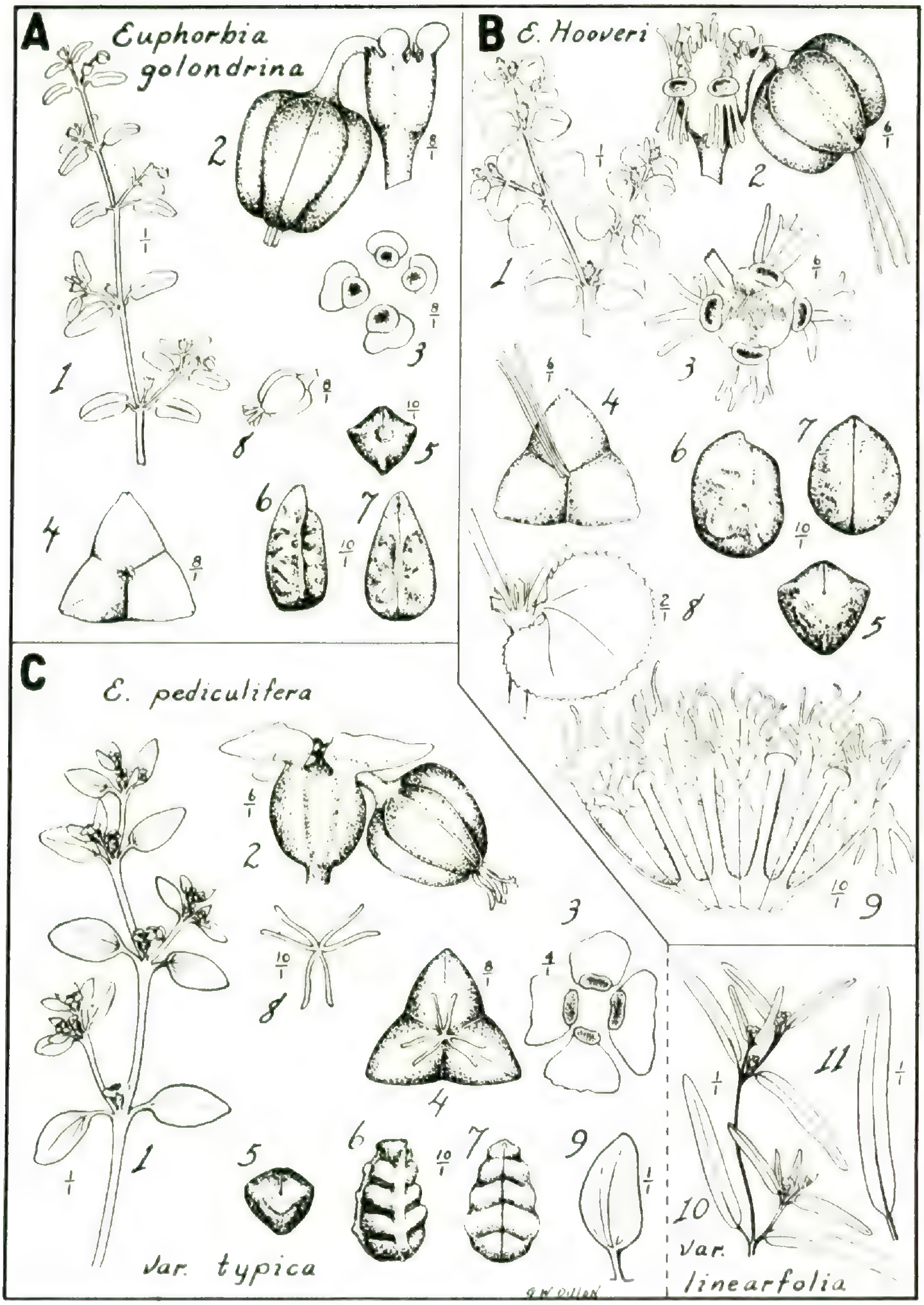
Prostrate annual, often very leafy, herbage glabrous throughout; stems slender, up to 50 cm. long, internodes to 3 cm. long, nodes sometimes rooting; leaf-blades 2–7 mm. long, ovate-orbicular to oblong, base oblique except in the smallest, margin

entire; petioles mostly less than 1 mm. long; both upper and lower stipules united into a white, membranous, glabrous scale less than 1 mm. long with more or less lacerate margin; peduncles up to 2 mm. long, expanding upward, glabrous; cyathia solitary at the nodes; involucres turbinate, 1 mm. long, 1 mm. diam., tapering to the thick upper end of the peduncle, glabrous without and within; lobes deltoid, sometimes with a few hairs on the margins below, apex acute to attenuate, equaling or slightly exceeding the glands; glands transversely oblong, ca. 0.2 mm. long, ochroleucous, concave; appendages mostly present, little wider than the glands, white, glabrous, margin mostly crenate; fifth gland linear, exceeding the glands, with a few marginal hairs at the base; sinus slightly depressed; bracteoles forming a single, linear or broader, entire or parted, slightly hairy appendage 0.6 mm. long or shorter, adnate below to the involucre opposite each gland; staminate flowers 5–10 per cyathium; androphores glabrous, 0.9–1 mm. long, equaling the glands; gynophore glabrous, exserted and mostly reflexed at maturity; ovary 3-lobed, glabrous; styles glabrous, markedly clavate, 0.2 mm. long, usually parted to below the middle, rotately spreading; capsule glabrous, 3-angled, ca. 1.2 mm. long; seeds smooth, ovoid with rounded angles or somewhat turgid-quadrangular with more prominent angles, ca. 1 mm. long, ca. 0.5 mm. radially and tangentially, coat microreticulate, white, with the brown testa showing through.—PLATE 661C.

Casual introduction in New Hampshire, New Jersey, Pennsylvania and probably Georgia; Ontario, Ohio, Indiana, Tennessee, Alabama and Florida, west to Arizona and New Mexico, north to Colorado and Montana, east to North Dakota, Iowa, and Illinois; south to South America, introduced in the Old World (MAP 37). Representative specimens seen from the United States and Canada: ONTARIO. Kent Co.: Chatham, *Macoun 5897* (NY, US). Middlesex Co.: London, June 9, 1883, *Burgess* (US). Windsor Co.: Windsor, Oct. 5, 1885, *Macoun* (G). NEW HAMPSHIRE: Belknap Co.: Gilmanton, 1867, *Blake* (US). NEW JERSEY. Co.?: on ballast sand, Petty's Island, Aug. 27, 1866, *Parker* (G, M). PENNSYLVANIA: Philadelphia Co.: Navy Yard, Philadelphia, Oct., 1865, *Burk* (PhB). OHIO. Sandusky Co.: Sandusky, Oct. 14, 1902, *Moseley* (US). INDIANA. Perry Co.: 5½ miles above Cannelton on Ohio River, *Deam 33357* (Deam, G). ILLINOIS. Fulton Co.: Canton, 1881, *Wolfe* (US). Menard Co.: Athens, Aug., 1886, *Hall* (US). St. Clair Co.: Cahokia, *Eggert* (NY). TENNESSEE. Davidson Co.: Nashville, Aug. 31, 1877, *Ward* (US). GEORGIA. Glynn Co.: waste places among rosin wharves, Brunswick, *Harper 1520* (G, NY, US). FLORIDA. Franklin Co.: Apalachicola, *Biltmore Herb. 3848a* (G, NY, US). ALABAMA. Hale Co.: Rosemary, *Harper 3248* (G, NY, US).



WHEELER on EUPHORBIA



WHEELER ON EUPHORBIA

Perry Co.: Uniontown, 1889, *Newman* (US). Mobile Co.: Mobile, July 14, 1891, *Mohr* (US). Mississippi. Lowndes Co.: Artesia, *Tracy 3125* (NY). Iowa. Webster Co.: *Somes 3841* (US). Woodbury Co.: Sioux City, *Pammel 192* (NY). Missouri. Jackson Co.: Courtney, *Bush 412* (NY, US). St. Clair Co.: 3½ miles north of Iconium on Osage River, *Steyermark 24316* (NY). Arkansas. Johnson Co.: Pine Bluff, *Demaree 8778* (NY, US). Pulaski Co.: Little Rock, *Coville 10* (US). Louisiana. Caddo Co.: Shreveport, *Cocks 3625* (NY). Orleans Co.: New Orleans, July, 1837, *Riddell & Carpenter* (US). Feliciana, *Carpenter* (US). North Dakota. Morton Co.: Glen Ullin, *Bergman 2411* (M). South Dakota. Mellette Co.: White River, *Over 6131* (US). Cheyenne River bottom, July 16, 1896, *Wallace* (NY). Indian Creek, Aug. 1891, *Williams* (US). Nebraska. Knox Co.: Niobrara, *Clements 2717* (G, NY, US). Lancaster Co.: Lincoln, Aug., 1898, *Williamson* (Ph). Kearney Co.: Minden, Sept. 18, 1929, *Hapeman* (Ph). Franklin Co.: Franklin, Aug. 25, 1929, *Hapeman* (Ph). Kansas. Ellis Co.: near Hays, *Rydberg & Imler 1193* (NY). Osborne Co.: Osborne City, *Shear 176* (G, NY, US). Riley Co.: *Norton 469* (G, NY, US). Saline Co.: Salina, *Mohr* (US). Douglas Co.: Lawrence, July, *W. C. Stevens* (US). Miami Co.: Aug. 10, 1885, *Oyster* (NY). Hamilton Co.: Syracuse, *Rose & Fitch 17011* (NY, US). Kiowa Co.: Belvidere, Sept. 26, 1897, *Ward* (US). Oklahoma. Woods Co.: Alva, *G. W. Stevens 1604* (G, NY, US). Kay Co.: Tonkawa, *G. W. Stevens 1863* (G, NY, US). Blaine Co.: Canton, *G. W. Stevens 834* (G, NY). Cleveland Co.: Norman, *Emig 527* (US). Texas. Austin Co.: Industry, 1846, *Lindheimer 300 Fasc. III* (US). Bexar Co.: near Bracken, *Groth 15* (G, US). Brazoria Co.: Columbia, *Bush 136* (NY). Cameron Co.: near Point Isabel, *Tharp 1180* (US): Dallas Co.: Dallas, *Stephenson 191* (US). Harris Co.: Hockley, *Thuron 4* (US). Howard Co.: Big Springs, *Tracy 8127* (Mo, NY, US). Jackson Co.: Carancahua Pt., *Tharp 1416* (US). Potter Co.: Amarillo, *Ball 1275* (US). Lubbock Co.: Lubbock, *Reed 3005* (US). Nueces Co.: Corpus Christi, *Heller 1463* (NY, US). Red River Co.: Clarksville, Sept. 25, 1894, *Plank* (NY). Starr Co.: 5 miles north of Rio Grande City, *Clover 1364* (NY). Tarrant Co.: Grapeland, *Tharp 881* (US). Taylor Co.: Abilene, *Tracy 7844* (Mo, NY, US). Travis Co.: near Austin, *Armer 5390* (US). Valverde Co.: bank of the Rio Grande, Del Rio, June 13, 1891, *Dewey* (US). Walker Co.: near Huntsville, *Dixon 376* (NY). Waller Co.: Hempstead, 1872, *Hall* (US). Webb Co.: Laredo, *Reverchon 3787* (G, US). Wharton Co.: Pierce, *Tracy 7435* (G, NY, US). Wilson Co.: Sutherland Springs, Aug. 22–30, 1879, *Ed. Palmer 1191* (G, US). Montana. Cascade Co.: Great Falls, *Williams 160* (US). Colorado. Weld Co.: New Windsor, Aug. 8, 1901, *Osterhout 2345* (NY).

New Mexico. Valencia Co.: near McArty's Ranch, *Rusby 378½* (M, NY). Chaves Co.: 20 miles south Rosswell, *F. S. & E. S. Earle 308* (M, NY, US). Eddy Co.: Carlsbad, *Tracy 8170* (NY, US). Doña Ana Co.: west of Organ Mountains, Aug. 26, 1899, *Wooton* (US). Arizona. Santa Cruz Co.: Santa Cruz River at La Noria, *Mearns 1192* (US). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 448–9. 1936.

31. Euphorbia albomarginata T. & G., Rep. Expl. & Surv. Miss. R. to Pacific Ocean **2** (**4**)**:** 174. 1855. Type: Rio Pecos, Texas, Nov. 1850, *Thurber 98* (NY!; photographs G!, W!; isotype G!). The common late-season phase with small leaves and short internodes. L. C. Wheeler, Bull. Torr. Bot. Club **63:** 446–7. 1936.—*E. stipulacea* Engelm. ex Boiss. in DC. Prod. **15** (**2**)**:** 30. 1862, in synonymy.—*Anisophyllum albomarginatum* (T. & G.) Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 53. 1860.—*Chamaesyce albomarginata* (T. & G.) Small, Fl. Se. U. S., 710, 1333. 1903.

Glabrous prostrate perennial from a taproot woody in age; stems several to numerous, up to 40 cm. long, internodes up to 6 cm. long but usually much shorter, nodes often rooting; leaf-blades mostly 3–6 mm. long, sometimes as much as 15 mm. long, orbicular to oblong, sometimes with a red spot in the middle on the upper surface, midrib usually not prominent, lateral veins rarely evident, margin entire; petioles 0.5–1 mm. long; both upper and lower stipules united into a glabrous, white, membranous, deltoid to subulate, usually lacerate-margined scale; cyathia solitary at the nodes; peduncles slender, glabrous, mostly 2–4 mm. long; involucres 1.5–2 mm. diam., open-campanulate to broadly obconical, glabrous without and within except on the lobes; lobes short-hairy within below, exceeding the glands, narrowly deltoid-attenuate; glands 0.5–1 mm. long, transversely oblong, concave, ochroleucous or mostly maroon; appendages usually conspicuous, wider and longer than the glands, white, glabrous, entire or slightly crenate; fifth gland linear, equaling the lobes, hairy within below; sinus U-shaped, little depresssed; bracteoles forming one conspicuous, upwardly expanded, mostly 2–4-divided, hairy radial appendage two-thirds as long to as long as the androphores, adnate below to the involucre opposite each gland; staminate flowers 3–6 per fascicle, 15–30 per involucre; androphores 1–1.3 mm. long, glabrous; gynophore glabrous, long-exserted and mostly reflexed at maturity; ovary glabrous, three-lobed; styles bifid to below the middle, 0.5–0.7 mm. long, glabrous, clavate, spreading-erect; capsule sharply three-angled, glabrous, ovoid, 1.7–2.3 mm. long; seeds 1.2–1.7 mm. long, 0.7–0.8 mm. radially, 0.7–0.9 tangentially, quadrangular, narrowly oblong to oblong-ovate radially, base obtuse or truncate, facets concave or convex, smooth, angles mostly rounded, coat micro-

reticulate in definite lines, opaque-white or so thin as to little obscure the brown testa.—PLATE 661D.

Southern San Joaquin Valley, Inyo Co., south through southern California, east to Nevada, Utah, Arizona, New Mexico, Texas and Oklahoma, south to Lower California, east to Tamaulipas (MAP 23). Representative specimens seen: CALIFORNIA. Tulare Co.: Porterville, Sept. 20, 1921, *Kelly* (CA). Kings-Tulare Co.: between Tulare and Tulare Lake, 1892, *Ed. Palmer 2721* (US). Kern Co.: Bakersfield, *Davy 1883* (C); Randsburg, Mohave Desert, Apr. 14, 1905, *Heller* (NY, Ph, US). Ventura Co.: near Frazier Borax Mine, Mt. Pinos, *Abrams & McGregor 206* (D, G, NY, US). Inyo Co.: Shepherd Canyon, Argus Mountains, *Coville & Funston 735* (G, NY). Los Angeles Co.: Santa Monica Hills, *G. B. Grant 427* (US); North Fork, San Gabriel, *Leiberg 3374* (US); San Bernardino Co.: Kessler Peak, Ivanpah Mountains, Mohave Desert, *Jepson 15829* (J); Holcomb Valley, San Bernardino Mountains, altitude 7,200 feet, *Ewan 4872* (G); Redlands, *Kuntze 23263* (NY); Hesperia, Mohave Desert, *Spencer 552* (G, NY). Riverside Co.: Paloverde, Colorado Desert, *Schellenger 78* (J); San Jacinto Valley, *Vasey 574* (US). San Diego Co.: head of Box Canyon near Mason Valley, *Duran 3205* (G, I, NY, O, US). Imperial Co.: on ditch banks, Experiment Farm, Bard, Apr. 5, 1912, *Dewey* (US); Fort Yuma, *Jepson 11734* (J). NEVADA. Nye Co.: Rhyolite, *Heller 9674* (G, US); gravel canyon-bottom, road to Beatty, east side Grapevine Mountains, Death Valley Region, *Train 676* (US). Clark Co.: Moapa, *Kennedy 1089* (NY, US); Kiernan's, Meadow Valley Wash, *Goodding 654* (NY, US); Mormon Mesa, *Eastwood & Howell 6310* (G); Las Vegas, *Goodding 2301* (G, NY). UTAH. Washington Co.: mesa northwest of Hurricane, *Maguire & Blood 1436* (I); near St. George, *Wann 27* (I). ARIZONA. Mohave Co.: plain near Oatman, April, 1916, *Creighton* (Ph); Peach Springs, April, 1893, *Wilson* (G). Coconino Co.: Turkey Tanks, *MacDougal 141* (G, US); north from San Francisco Peaks, *Leiberg 5573* (US). Navajo Co.: Winslow, 2 miles north in desert, *Stone 373* (NY); Pinedale, *Hough 126* (US). Apache Co.: between Chambers and Navajo, *Eastwood & Howell 6893* (G). Yavapai Co.: Prescott, Aug. 7, 1876, *Ed. Palmer 509* (G, US). Maricopa Co.: Hassayampa, *Newlon 584* (J). Pinal Co.: sandy river bottom, Gila River, 2 miles below Coolidge Dam, *Maguire, Richards & Moeller 10421* (G, I). Gila Co.: Roosevelt Dam, *Goodding 723* (G, NY, US). Greenlee Co.: face of conglomerate cliff above San Francisco River banks, S. Clifton, *Maguire, Richards & Moeller 11788* (G, I). Graham Co.: ¼ mile west Upper Reservoir Plat, 10 miles southwest Safford, *Maguire 10007* (I). Pima Co.: Santa Cruz Valley near Tucson, May 2, 1881, *Pringle* (G, NY, US); Tucson, Nov. 30, 1894, *Toumey* (G, NY,

US). Santa Cruz Co.: vicinity of Ruby, *Mrs. A. F. Morton 88* (US). Cochise Co.: Tanner's Canyon, Huachuca Mountains, *Holzner 1573* (US); Paradise, *Blumer 1691* (G, NY, US); San Bernardino Ranch, Mex. Boundary Line, *Mearns 639* (NY, US). New Mexico: McKinley Co.: Ft. Wingate, *Rusby 380* (NY, US). Quay Co.: Tucumcari, red clay soil, *Fisher 74* (US). Socorro Co.: Magdalena to Water Canyon, *Eggleston 20227* (NY, US). Lincoln Co.: 4 miles above Tularosa, White Mountains, *Wooton & Standley 3617* (US). Chaves Co.: 20 miles south of Roswell, *F. S. & E. S. Earle 309* (NY, P, US). Sierra Co.: Lake Valley, Sept., 1914, *Beals* (US). Grant Co.: Mangas Springs, 18 miles northwest of Silver City, *Metcalfe 722* (G, NY, US); 5 miles east of junction of Mule Creek road, on Mule Creek Highway, *Maguire, Richards & Moeller 11918* (G, I). Luna Co.: Deming, *Evans 5* (NY); Carrizallilo Mountains, *Mearns 153* (US). Doña Ana Co.: mesa near Las Cruces, *Wooton 75* (NY, US). Eddy Co.: dry plains east of Carlsbad, *Standley 40295* (US). Oklahoma. Harmon Co.: field near Hollis, *G. W. Stevens 1105* (D, G, M, NY, US). Texas: Lubbock Co.: Lubbock, *Demaree 7525* (US). Hudspeth Co.: Rio Grande at Bosque Bonita Crossing, *Cory 1935* (G). Reeves Co.: Verhalen, *Cory 1926* (G). Ward Co.: Barstow, *Tracy 437* (G, Mo, NY, US). Jeff Davis Co.: Limpia Canyon, *Tharp 4427* (US). Presidio Co.: Shafter, infrequent, valleys, *Hanson 552* (NY, US). Brewster Co.: along Rio Grande near Lajitas, Chisos Mountain area, *Warnock 665* (US). Crockett Co.: Ozona, *M. E. Jones 26001* (I, W). Dallas Co.: Dallas, *Bush 650* (G, NY, US). Tom Green Co.: Knickerbocker Ranch, Dove Creek, *Tweedy 268* (US). Bexar Co.: San Antonio, dry rocky ground, *E. J. Palmer 33786* (NY, US). Wilson Co.: Sutherland Springs, Aug. 1879, *Ed. Palmer 1207* (G). Zavala Co.: Crystal City, *Hanson 685* (G, US). Duval Co.: San Diego, *Croft 202* (US). Starr Co.: Rio Grande City, *Neally 221* (US). Hidalgo Co.: Abrams, June 9, 1928, *Bogusch & Molby* (O). Cameron Co.: Kingsville, *Tracy 9125* (G, NY, US). Rio Hondo, *Chandler 7026* (G, NY, US). MEXICO: Baja California: between Ojos Negros and Neji Rancho, *Wiggins & Gillespie 4141* (G, NY, O, US); Gardner's Laguna, *Schoenfeldt 2896* (US). Sonora: dry reservoir, Alamo, west Magdalena, *Kennedy 7076* (US); 5 miles south of Nacori, *Lloyd 458* (G); Arroyo de Cocoragua south of Velderrain, *Pennell 19477* (US); Alamos, arroyo, *Rose, Standley & Russell 12935* (US); Magdalena, *Rose, Standley & Russell 15074* (NY, US). Sinaloa: Culiacan, *Rose, Standley & Russell 14934* (NY, US). Chihuahua: Rio Santa Maria, *Thurber 749* (G, NY); 6 miles west of Piloncillo, *Johnston 7862* (G); Casas Grandes, *Goldman 406* (G, US); near Chihuahua, Apr. 8–27, 1908, *Ed. Palmer 15* (G, NY, US); Llano de Chilicote, 7 miles east of Chilocote Station, *Johnston 7991* (G); Santo

Tomas on railroad northwest of San Isidro, Sierra Madre Occidental, *Pennell 18991* (US). DURANGO: Durango and vicinity, June, 1896, *Ed. Palmer 296* (C, F, G); Santiago Papasquiaro, Apr., 1896, *Ed. Palmer 42* (C, F, G, US). COAHUILA: Municipio de Muzquiz, Hacienda Mariposa, open brush land near Puerto Santa Ana, *Wynd & Mueller 274* (G, NY, US). NUEVO LEON: Monterey, *Dodge 83* (US). TAMAULIPAS: Victoria, Feb. 1 to Apr. 9, 1907, *Ed. Palmer 92* (US). For citation of additional collections see Bull. Torr. Bot. Club **63:** 446–447. 1936.

The Thurber specimen here taken as type is from Torrey's herbarium and is labeled "*Euphorbia albomarginata* Torr. & Gray" presumably in Torrey's hand. This specimen is accompanied by diagnostic drawings. This choice of type preserves the customary interpretation of this well known species. The original diagnosis would not distinguish *E. Fendleri* nor *E. polycarpa* from *E. albomarginata.* However, in spite of that and the fact that some specimens of *E. Fendleri* were labeled as *E. albomarginata* and the description of the seeds was probably drawn from them, the majority of specimens originally referred to *E. albomarginata* were that, and *E. Fendleri* was described on the next page. One specimen of *E. polycarpa* was included in the concept and part of the original diagnosis may have been based upon it. Nevertheless, about three-fourths of the specimens originally referred to *E. albomarginata* were specifically identical with the specimen here chosen as type.

Jepson's statement, Fl. Calif. **2**: 428. 1936: "type loc. 'headwaters of the Colorado,' that is, western Texas, *Diffenderfer;*" is based on the statement in the publication of *E. albomarginata* that it grew "with the preceding" (*E. Wrightii* T. & G.) which is reported from "Headwaters of the Colorado". This, combined with the statement on page 3 of the same volume that all the collections of plants of the expedition were made by Dr. W. L. Diffenderfer leads logically to Jepson's bibliographical conclusion. My selection is based on actual examination of the specimens from which the original diagnosis was drawn.

(*To be continued*)

OBSERVATIONS IN 1940 ON THE DISSEMINATION BY ANTS OF THE SEEDS OF TRILLIUM GRANDIFLORUM

Burton N. Gates

It has been possible to confirm in 1940, the observations made in 1939,[1] on the behavior of ants in the dissemination of seeds of *Trillium grandiflorum* Salisb. It was also determined that at least five ant species perform this dissemination.

In 1940, a populous, subterranean colony of *Formica neogogates* var. had established themselves in the lawn, about five feet from the group of *Trillium* plants. Before the *Trillium* seeds had ripened, July 19, 1940, ants from the nest were seen exploring the plants. As soon as ripe seeds were available, ants from this nest were tested to determine whether they would carry off seeds to their nest. To each of five ants, a freshly gathered *Trillium* seed was offered; each ant picked up the seed and carried it off in the direction of the nest. Each of these five ants was captured for the purpose of identification; each was identified[2] as the same species, *Formica neogogates* var. A sixth ant (not captured) was permitted to carry a fresh *Trillium* seed into the *Formica* nest.

It was presumed in 1939, that the ants not only ate the caruncle, but that they also gathered for food the pulp which surrounds the seeds in the capsule. In 1940, ants from the *Formica* nest were observed removing the fleshy pulp from the capsule; one ant carrying a fragment of pulp was traced to the nest.

As in 1939, a number of seed capsules which had been emptied, leaving only the thin shell of the capsule, were found beneath the plants. A ripe capsule which had just fallen was also watched. This soon became covered with the *Formica* ants, busy removing the seeds and pulp from the end which had broken away from the plant.

Although a considerable number of the *Trillium* seeds must have been carried into the *Formica* nest in the lawn, the presence of the grass around this nest made it most difficult to find any seeds which the ants had brought out of nest, after the caruncle

[1] Rhodora, vol. 42, number 497, page 194.
[2] All ant identifications were made by Mr. Lawrence G. Wesson, Boston, Mass., whose courtesy is greatly appreciated.

had been eaten off. Moreover, during the observations, there were numerous rains, some heavy, which may have washed away or covered discarded seeds. In contrast to the seventy seeds collected in and about the stone-pile ant nest in 1939, only two seeds could be found in 1940 which had been brought out of the *Formica* nest and dropped between the tufts of grass. These two, however, upon examination with a lens showed clearly the roughened surface close to the seed coat, where the caruncle had been gnawed away, without doubt for food. This indicates that the habit of finally casting out from the nest, the seeds from which the caruncle has been gnawed is relatively a constant behavior.

It was desirable to determine to what extent the *Trillium* seeds might be gathered by ant species other than *Formica neogogates* var. For this purpose some freshly gathered seeds were taken to another part of the grounds, at least one hundred feet from the group of plants. A seed was offered indiscriminately to any ant seen. If the ant picked up the seed and started off with it, that ant was collected for identification. Five ants responded and picked up the seed; none refused. Moreover, some ants too small to carry a seed, climbed upon it and apparently gnawed at the caruncle. Presumably, a considerable number of ant species, in the locality where *Trillium grandiflorum* grows, participate in the dissemination of the seeds.

The identifications by Mr. Wesson of ants tested at random, are:

1. A small specimen (brownish), *Lasius niger* var. *americanus.*
2. A larger ant (brownish), *Myrmica fracticornis.*
3. Two large black specimens. *Formica fusca subsericea.*
4. Large ant (black), *Camponotus herculeanus pennsylvanicus.*

Department of Agriculture,
State House, Boston

Vicia lathyroides in eastern Virginia and new to North America.—On March 30, 1937, while in Middlesex County, Virginia an occasion arose for an early-season field-trip into the region around Deltaville. The area is the tip of a small peninsula between the Rappahannock and the Piankatank Rivers, at the

point where they empty into the Chesapeake Bay. The soil is sand of the lower coastal terrace. Matted in the sand along the inner beach at Stingrey Point was found a small *Vicia*-like plant without flower or fruit. Specimens were taken and attempts at determination were unsuccessful. Handling of sheets of undetermined material recently brought these specimens to attention again. Some of them were sent to Mr. Robert F. Martin, of the Bureau of Plant Industry, Washington, D. C., for comparing with herbarium material. He has determined it as *Vicia lathyroides* L., a European species apparently not previously reported in North America. Professor Fernald informs me, however, that there is flowering and fruiting material in the Gray Herbarium, collected on May 21, 1931 and again in May, 1933 on Nantucket Island, Massachusetts, by Mr. and Mrs. Alfred F. Shurrocks, who wrote of it: "there are carpets, covering acres. . . . It also covers large portions of a field—an old barn lot— . . . and in scattering quantities in other fields." Sheets of the Virginia material have been placed in the Herbarium of the National Arboretum and in the Gray Herbarium.

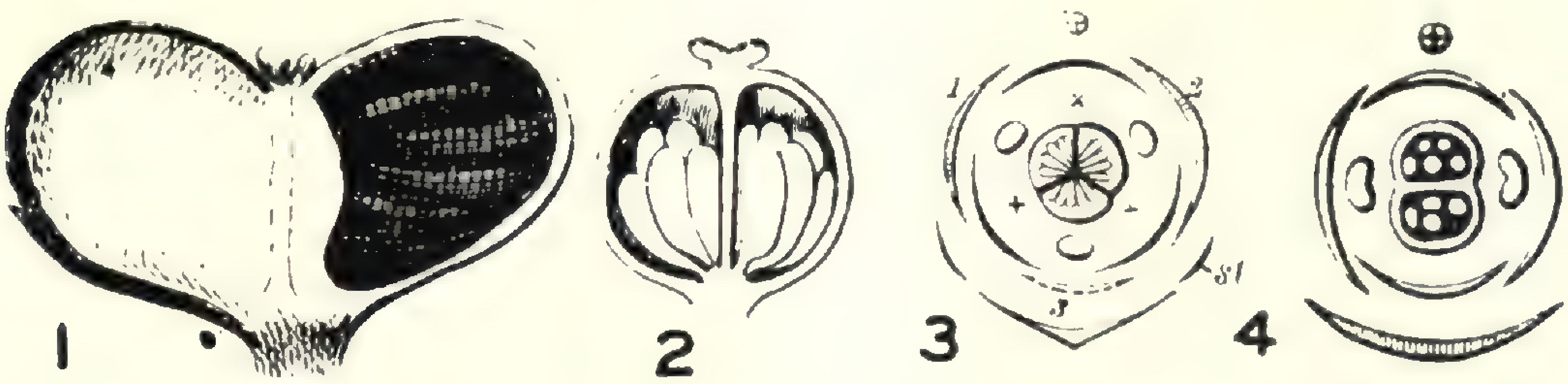
The species will be studied more closely in the field during 1941 and carefully compared with European material.—A. B. Massey, Virginia Polytechnic Institute, Blacksburg, Virginia.

ELATINE AMERICANA AND E. TRIANDRA

M. L. Fernald

The eastern North American *Elatine americana* (Pursh) Arn. has been generally recognized as an endemic species—by Pursh, Arnott, Torrey & Gray, Seubert, Fenzl and others. The habitally similar *E. minima* (Nutt.) Fisch. & Meyer was long confused with it, but in Rhodora, xix. 12 and 13 (1917), I pointed out the differences between them. Subsequently, Fassett, in Rhodora, xxxiii. 72 (1931), has differed from me, in treating *E. americana* as a variety of the largely Old World *E. triandra* Schkuhr and he has reaffirmed this opinion in vol. xli. 373 (1939). His reasoning, as stated in 1931, was, that in its terrestrial state *E. triandra* simulates *E. americana* which has only the terrestrial state and, although in deep water *E. triandra* elongates, like the

aquatic species of *Callitriche*, while *E. americana* does not do so, "an aquatic state like [*E. triandra*] forma *callitrichoides* should be sought in *E. americana*." Furthermore, Fassett felt that "The lack of an elongate aquatic form of the estuarine plant [*E. americana*] has a parallel in the case of *Eriocaulon*. *E*[*riocaulon*]. *septangulare*, growing sometimes in as much as 2 m. of water, produces elongate scapes raising the heads to the surface. But the doubtfully distinct *E*[*riocaulon*]. *Parkeri* of estuaries, alternately deeply submerged and left stranded on the mud, remains short and stocky like the *E. septangulare* found on the shore." Further assumed parallelisms were given by Fassett, one of them leading him to the conclusion that "*E*[*latine*].



ELATINE TRIANDRA: FIG. 1, vertical section of fruit, after *Seubert;* FIG. 3, horizontal section of flower, after *Eichler*.
E. MINIMA (with seed attached much as in E. AMERICANA): FIG. 2, vertical section of fruit, after *Gray;* FIG. 4, horizontal section of flower, after *Eichler* (copied from *Gray*).

triandra . . . var. *americana* has somewhat the relation to *E. triandra* that *Limosella subulata* has to *L. aquatica*."

Since I have not been able to follow Fassett in reducing *Elatine americana* to varietal rank under *E. triandra* and have, consequently, been several times challenged and tacitly reproved for holding to my earlier decision, in keeping *E. americana* apart, it becomes necessary, in the interest of exact taxonomy, to state my reasons. So far as I can detect Fassett has not discussed the fundamental differences in position of ovules and seeds, so clearly understood by Nuttall, Eichler, Asa Gray and others, which seem to me far more significant than variations of leaf-outline. *E. triandra*, as beautifully shown by Seubert in his *Elatinarum Monographia* in Acad. Caes. Leop. Nova Acta, xxi. t. II. fig. 6 (1845), here reproduced as FIGURE 1, has the seeds borne the whole length of the central axis and horizontally divergent; whereas the seeds of the American *E. americana* and

E. minima are borne at the base of the central axis and stand vertically. This fundamental morphological difference has been recognized by most students of the group since Nuttall published the genus *Crypta* in Journ. Acad. Nat. Sci. Phila. i. 117 (1817), based upon *C. minima* Nutt. (*Elatine minima*) of which he gave a most detailed analysis, including "seeds attached to a small basilar and common receptacle". Gray, Gen. Pl. U. S. Ill. i. 219 (1848), set up for *E. americana* (in which he included *Crypta minima*) the subgenus *Crypta* (Nutt.) Gray, with "Placentae basilares, oligospermae . . . a basilar placenta bearing 6 to 12 erect seeds". In the same work subgenus *Crypta* was illustrated by Sprague's drawings of details of *E. minima*, the type of the subgenus, in plate 95. Sprague's drawing of the basally attached and erect seeds, such as can be seen by slight magnification in fruit of *E. americana* and *E. minima*, is here reproduced as FIGURE 2, although Gray later wrote of this figure, "In good fruits, the seeds are rather more numerous . . . in insertion they are not so basal, yet all are ascending.[1] The contrast in position of the seeds in *E. triandra* on the one hand and *E. americana* and *E. minima* on the other was well brought out by Eichler, Blüthendiagramme, ii. fig. 95 C, of *E. triandra*, and fig. 96, of *E. minima* (1872). These diagrams, here reproduced as FIGURES 3 and 4, show in the ovary of *E. triandra* (viewed from above) the horizontally divergent ovules, in *E. minima* the vertical ones. Without enumerating all the careful studies of *Elatine* in which this fundamental morphological difference is brought out, it is sufficient to note that Gray regularly recognized it, saying in his treatment of *Elatine* in the Synoptical Flora of North America, 1^1. 281 (1897), under *E. triandra* "seeds ascending over the whole thickened axis of the capsule", under *E. americana* (including *minima*), "in aquatic form [i. e. *E. minima*] . . . ovules and seeds mainly basilar", "in terrestrial form [i. e. *E. americana*] . . . more axile". In Gray's Manual, ed. 7: 579 (1908) the same morphological difference was expressed under *E. americana* by "*seeds* . . . rising from the base", under *E. triandra* by "seeds . . . covering the axis." Reexamination convinces me that I am not in error in following Nuttall, Gray, Seubert, Eichler and many others in keeping *E. americana* apart from *E. triandra* and

[1] Gray, *Elatines Americanae* in Proc. Am. Acad. xiii. 363 (1878), Gray here referring to fruiting *E. americana*, rather than *E. minima*.

in following Gray in recognizing as a species *E. brachysperma* Gray.

In view of the implication that *Eriocaulon Parkeri* is "doubtfully distinct" from *E. septangulare*, it may be pointed out that I propose to use the following key-characters in the next edition of Gray's Manual.

E. SEPTANGULARE: mature heads depressed-globose, the abundant and crowded marginal flowers tending to push back and hide the involucre; chaff and flowers fringed by abundant, elongate white club-shaped trichomes; seeds subglobose, rarely globose-ellipsoid.

E. PARKERI: mature heads depressed-hemispherical, loosely few-flowered; involucre not reflexed nor hidden; chaff and flowers glabrous or nearly so; seeds ellipsoid, rarely subglobose.

In eastern Canada and the Atlantic States the ranges and habitats of *Eriocaulon Parkeri* and of *Elatine americana* largely coincide; in the same region *Elatine minima* is found within the broad range of and often associated with *Eriocaulon septangulare*.

GNAPHALIUM OBTUSIFOLIUM VAR. MICRADENIUM IN NEW HAMPSHIRE AND SOUTH CAROLINA.—It may be worth while to record, somewhat belatedly, the occurrence of *Gnaphalium obtusifolium* var. *micradenium* Weath. in New Hampshire. A small colony of it was found Sept. 2, 1936, during a field-trip of the New England Botanical Club, along a wood-road in dry sandy woods in the township of Ossipee. This station does not constitute an extension of range, the variety having been found by Fernald and Long in Limington, Maine, a few miles to the east. It is, however, so far as I know, the first record for New Hampshire. No other New England stations than these two are known to me north of Cape Cod.

Another collection has recently been received at the Gray Herbarium which does extend, southward, the range as given when the variety was published in RHODORA xxv. 22 (1923),—pine barren, near Pineville, Berkeley County, South Carolina, Sept. 11, 1939, *Godfrey* 8195. Messrs. Fernald and Long have added several localities in southeastern Virginia. Specimens from Pike County, Arkansas, *Demaree* 9373A, distributed as var. *micradenium*, are var. *Helleri* (Britton) Blake.—C. A. WEATHERBY, Gray Herbarium,

California Shrubs.[1]—This work is a worthy companion to the earlier *Illustrated Manual of Pacific Coast Trees.* It is well conceived, amply illustrated and handsomely bound. The book includes, according to the author's statement in the preface, "all of those vegetative forms classified as woody perennials and semi-woody plants except trees and the succulent-stemmed shrubs of the Cactus Family." Trees are contrasted with shrubs on page 7 of the introduction where it is stated "In trees the stem is a single woody trunk and does not branch for some distance above the ground. In shrubs the woody trunks branch at or near the ground and the stems and branches grow to form bush-like plants". Just where the dividing line may be drawn between a shrub and an herb with a woody perennial base is not disclosed. It is obvious that the decision to call certain plants shrubs and others trees on the one hand and herbs on the other hand must be somewhat arbitrary. In certain genera such as *Salix* and *Quercus* where reasonable doubt may exist in the reader's mind as to a plant's status it would have been helpful if the relatively few species excluded as trees had been included in the keys. This procedure was followed in some cases such as *Eriogonum* where certain herbaceous species are incorporated into the key.

In a book designed primarily for the general public there is always the danger of sacrificing accuracy in keys and descriptions in order to obtain simplicity. McMinn has evaded this pitfall and has included in his introduction a clear and concise explanation of terms to aid the reader.

The major portion of the work consists of keys and descriptions of the various species. The distribution of each species is also noted as well as valuable information on the cultivation of the plants in the garden. Most of the species are illustrated by small but pertinent cuts which are supplemented by many excellent half-tones. At the end is a glossary of botanical terms and a glossary of the meanings of specific names which should be of interest to many users. There is also a supplementary chapter by Fred H. Schumacher on the use of California shrubs in garden design.

I should think that the book would be indispensable to anyone interested in the flora of California.—Stuart K. Harris, Boston University.

[1] *An Illustrated Manual of California Shrubs*, by Howard E. McMinn. 689 + xi pp.; 775 fig. San Francisco. J. W. Stacey, Inc.

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The New England Botanical Club, Inc.

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ADDITIONAL RECORDS OF MARINE ALGAE FROM NEW HAMPSHIRE*

Hannah T. Croasdale

At the turn of the century New Hampshire, with only 14 miles of coast line, was very conscious of its marine algal flora. When Collins, in 1900, published his preliminary list of New England Algae he included 120 species from this state, and he found six more during the next few years. Since then, however, New Hampshire's marine algae have been almost entirely neglected, and Taylor's recent excellent book on "Marine Algae of the Northeastern Coast of North America" makes it evident that Collins' 1900 list can no longer be considered complete.

Thanks to the generous hospitality of Professor C. F. Jackson, Director of the Marine Zoological Laboratory of the University of New Hampshire, the writer has had the opportunity of visiting this laboratory for short periods during two summers and collecting from New Hampshire stations among the Isles of Shoals. The products of these collections, and of collections along the coast in other seasons, added to the six species noted in the literature or exsiccatae since 1900, have resulted in the following 32 additional records to the state flora.

Chaetomorpha aerea (Dillw.) Kütz. Star Is., July, 1938. 1940.
Enteromorpha micrococca Kütz. Star Is., July, 1938. 1940.
Enteromorpha prolifera (Müll.) J. Ag. Star Is., July, 1938. 1940.
Protoderma marinum Reinke. Newcastle, May, 1900 (*Collins*, 1901).

* Contribution to the Biological Survey of New Hampshire.

Spongomorpha lanosa (Roth) Kütz.,
var. uncialis (Müll.) Kjell. White Is., July, 1940.
Spongomorpha spinescens Kütz. White Is., July, 1940.
Ulothrix inplexa (Kütz.) Kütz. Little Boars Head, May, 1902 (*Hazen*, 1902).
Ulva lactuca L., var. latissima (L.) DC. Little Bay, July, 1940.
Ascophyllum nodosum (L.) LeJol,
fa. scorpioides (Hornem.) Reinke. Portsmouth, April, 1938; May, 1940.
Chordaria flagelliformis (Müll.) J. Ag.,
var. densa Farlow. Little Boars Head, May, 1940.
Dictyosiphon foeniculaceus (Huds.) Grev.,
var. hispidus (Kjell.) Collins. Little Boars Head, May, 1940.
Ectocarpus penicillatus (C. Ag.) Kjell. Dredged off Lunging Is., July, 1938.
Elachistea lubrica Ruprecht. Star Is., July, 1938.
Fucus spiralis L. Star Is., July, 1938. 1940.
Laminaria digitata (L.) Edmondson. Star Is., July, 1938. 1940.
" " , var. ensifolia (LeJol.) Fos. White Is., July, 1940.
Laminaria intermedia Foslie,
var. longipes Foslie. Star Is., July, 1940.
Punctaria latifolia Grev. Star Is., July, 1938. 1940.
Ralfsia Borneti Kuckuck. Newcastle, May, 1900 (*Collins*, PB-A).
Sphacelaria cirrhosa (Roth) C. Ag.,
fa. meridionalis Sauv. White Is., July, 1940.
Acrochaetium alariae (Jons) Born. "New Hampshire" (*Collins*, 1906).
Antithamnion boreale (Gobi) Kjell. Dredged off Lunging Is., July, 1938.
Antithamnion cruciatum (C. Ag.) Näg. Star Is., July, 1938.
Callithamnion Baileyi Harv. Little Bay, July, 1940.
Callithamnion tetragonum (Wither.) C. Ag. Star Is., July, 1940.
Ceramium diaphanum (Lightf.) Roth. Little Bay, July, 1940.
Ceramium rubriforme Kylin. Hampton Beach (leg. W. Hatch), May, 1938.
Dumontia incrassata (Müll.) Lamour. Hampton Beach, April, 1938.
Gracilaria foliifera (Forrskal) Børg. Little Bay, July, 1940.
Polysiphonia elongata (Huds.) Harv. Portsmouth (leg. R. Thorne), Oct., 1940.
Porphyropsis coccinea (J. Ag.) Rosenv. Hampton (*Collins*, 1903).
Rhodymenia palmata (L.) Grev. Star Is., July, 1938. 1940.

The writer is indebted to Dr. W. R. Taylor for making or confirming these identifications.

Specimens are in the author's collection and in the Isles of Shoals' Herbarium of the University of New Hampshire.

Fig. 1. Ascophyllum nodosum, fa. scorpioides.

Porphyropsis coccinea has the distinction of being found in New Hampshire and in no other New England state. Collins (1903) pointed this out, prophesying that it could not hold this distinction long, but, after nearly 40 years, the record still stands.

Of especial interest is *Ascophyllum nodosum*, fa. *scorpioides* which was found in fruit, sparsely in April of 1938 and abundantly in May of 1940. This is the first record of the occurrence of fruit in this form. *A. Mackaii* (Turn.) Holmes et Batters, which is found in similar habitats and closely resembles it in its vegetative

habit, has long tapering, often forked receptacles. The receptacles of *A. nodosum*, fa. *scorpioides*, on the other hand, are more or less oval, essentially similar to those of the type. The plants occupied their typical salt marsh habitat, associated with *A. nodosum* but easily distinguishable by their slender, tangled, subcylindrical branches and reduced bladders. The fruit suffered less reduction than the vegetative portion, and thus appeared by contrast very large. The receptacles were from oval to spatulate, yellowish, mostly simple, occasionally forked, on slender stalks. The fruiting portion was 0.4–1.6 cm. long, 0.2–0.7 cm. wide. The stalks were up to 2.5 cm. long, usually about 1.5 times the length of the fruiting portion. Only female receptacles were observed (Fig. 1).

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Dartmouth College

ON THE NAME OF THE OAK FERN[1]

C. V. Morton

The common Oak Fern of Europe and North America was originally described as *Polypodium Dryopteris* L. In order to avoid the tautonym *Dryopteris Dryopteris* in listing the species of *Dryopteris* for the Index Filicum, Christensen proposed the new name *Dryopteris Linnaeana*, which has since been generally accepted. It is the purpose of this paper to point out an earlier specific name, which must be applied to this fern.

The first such proposed is *Filix pumila* Gilib. (1792), but this is a *nomen abortivum*, since the Linnaean name *Polypodium Dryopteris* was cited in synonymy. It is, therefore, illegitimate

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by Article 60 (1) of the International Rules of Botanical Nomenclature. *Polypodium pulchellum* Salisb. (1796) also was superfluous when published, and comes in the same category, as does *Polypodium triangulare* Dulac (1867).

There is, however, a legitimate name in *Polypodium disjunctum* Rupr., which was not proposed as a change of name for the Linnaean species, but as a segregate. It was originally proposed as a subspecies, but in the invalid form *Polypodium Dryopteris* γ *P. disjunctum,* a binary nomenclature for subspecies prohibited by Article 28. However, the name was later taken up as a valid species by Schur in 1858, and the species must date from his publication. The relevant synonymy is as follows:

Dryopteris disjuncta (Rupr.) Morton, comb. nov.—*Polypodium Dryopteris* L. Sp. Pl. 1093. 1753. *Filix pumila* Gilib. Exer. Phyt. **2:** 558. 1792 (nom. abort.). *Polypodium pulchellum* Salisb. Prod. 403. 1796 (nom. abort.). "*Polypodium Dryopteris* γ *P. disjunctum*" Rupr. Distr. Cr. Vasc. Ross. 52. 1845. *Gymnocarpium Dryopteris* Newm. Phytol. **4**. App. XXIV. 1851. *Polypodium Dryopteris* var. *disjunctum* Ledeb. Fl. Ross. **4:** 509. 1853. *Polypodium disjunctum* Rupr. ex Schur, Oestr. Bot. Zeit. **8:** 193. 1858; Enum. Pl. Trans. 831. 1866. *Polypodium triangulare* Dulac, Fl. Hautes Pyrenees 31. 1867 (nom. abort.). *Phegopteris Dryopteris* subsp. *disjuncta* Trel. in Harrim. Alaska Exp. **5:** 382. 1904. *Dryopteris Linnaeana* C. Chr. Ind. Fil. 275. 1905. *Dryopteris pulchella* Hayek, Fl. Steierm. 39. 1908. *Dryopteris triangularis* Herter, Bull. Boiss. II. **8:** 797. 1908. *Dryopteris Dryopteris* Christ, Bull. Acad. Geogr. Bot. **20**[1]**:** 151. 1909. *Dryopteris Linnaeana* var. *disjuncta* Fomin, Fl. Siberia 79. 1930. *Gymnocarpium Dryopteris* var. *disjunctum* Ching, Contr. Biol. Lab. Sci. Soc. China **9:** 41. 1933.

The name *disjuncta* was based on specimens from Sitka, Alaska, and refers to certain large, lax forms that are essentially tripinnate, with the lower tertiary pinnules somewhat spaced out. Such forms occur in Idaho, British Columbia, and Alaska, and doubtless in Siberia and elsewhere. They do not seem to be worth nomenclatural recognition, which is fortunate, since such a course would necessitate applying a varietal name to the common widely distributed form. The recently proposed *f. glandulosa* Tryon, distinguished by having a glandular rhachis, is not well founded, since a few such glands are found on almost all European specimens.

There is a good deal of disagreement as to the proper generic disposition of this species. Ching has attempted to show that it represents a distinct generic type, *Gymnocarpium* Newm. In this treatment he has recently been followed by Christensen in the Manual of Pteridology. The points mentioned by Ching are as follows:

(1) *Rhizome wide-creeping, with a simple dictyostele, the leaf traces two, uniting only toward the tip of the blade. Dryopteris Thelypteris* and many other species have a wide-creeping rhizome and have also the same stelar structure, except that the leaf traces unite at the base of the blade. This difference is slight and is certainly not of generic importance, even if always true, which must be considered very doubtful in view of the fact that the stelar structure of most of the hundreds of species of *Dryopteris* subgenus *Lastrea* has not yet been investigated.

(2) *Lamina thin-herbaceous, green, pentangular, glabrous, "bent at the joint to the apex of the long slender stipe."* It is true that *Dryopteris disjuncta* has a very thin blade, but not more so than *Dryopteris noveboracensis, D. simulata, D. nevadensis,* and many other species of the subgenus *Lastrea.* Moreover, *D. Robertiana,* included in *Gymnocarpium* by Ching, has a noticeably thicker blade. *Dryopteris disjuncta* is rather distinctive in having a pentagonal blade, but *D. oyamensis,* which also is referred to *Gymnocarpium* by Ching, has a blade very much more like that of *D. Phegopteris* in outline. Thus, the only point left is the articulation of the lower pinnae. This is a true distinction, but I can not regard it as of generic importance.

(3) *Venation neither anadromous nor catadromous, but basal pinnules of the pinnae opposite.* This is an erroneous observation. Frequently they are opposite, but just as often they are anadromous. In any case, anadromous and catadromous venation both occur in *Dryopteris.*

(4) *Sori exindusiate, roundish in outline, and dorsal on the veins.* In *Dryopteris* as a whole the sori are always dorsal on the veins, and are typically round. There are many exindusiate species in tropical America belonging to several subgenera, e. g., *Stigmatopteris, Goniopteris, Meniscium, Ctenitis,* and *Lastrea.*

(5). *Spores bilateral, warty, and without perispore.* The spores of *Dryopteris,* with over 1000 existing species, have been insufficiently investigated to justify the implied distinction.

It is thus apparent that the genus *Gymnocarpium* can not be recognized unless one is willing to split up *Dryopteris* into many small genera, a course which has little to recommend it to botanists who have worked with the genus as a whole.

The genus *Phegopteris* as currently recognized is even more artificial than *Gymnocarpium*, including as it does both *Dryopteris Phegopteris* and *D. disjuncta*, which really are not closely allied. The characters supposed to distinguish *Phegopteris*, namely the creeping rhizome and the exindusiate sori, are found in many unrelated species of *Dryopteris*. Incidentally it may be mentioned that the name *Phegopteris polypodioides* Fée used by Gray's Manual, 7th ed., Wherry, and Broun, is not the oldest available name for the Beech Fern. Under *Phegopteris* the correct name would be *Phegopteris connectilis* (Michx.) Watt, based on *Polypodium connectile* Michx. (1803).

U. S. National Museum,
Washington, D. C.

Grass Studies. IV. Additional Species New to Arkansas.[1]—In connection with a current survey of the grasses of Arkansas, material of several species has been collected that appear to be heretofore unreported for the state. Notes pertaining to these collections are here briefly presented, indicating the locality where these have been found.

Andropogon Elliottii Chapm. Harrison, Boone County, January 20, 1938, *Nielsen*. One mile south of Mt. Gaylor, Crawford County, November 30, 1937, *Nielsen*, no. 5340. One mile south of Canfield, Lafayette County, November 11, 1937, *Nielsen*, no. 5291. Combs, Madison County, January 6, 1938, *Nielsen*, no. 5341. Resettlement Area, 14 miles west of Fayetteville, Washington County, March 20, 1938, *Nielsen*, no. 5345. Another specimen was taken in Oklahoma from between Heavener, Oklahoma, and the Arkansas boundary on November 12, 1937, *Nielsen*, no. 5288.

Deschampsia flexuosa (L.) Trin. Cameron Bluff, Mt. Magazine, Logan County, May 28, 1939, *Younge* and *Nielsen*, no. 5947.

Although this species was locally abundant on Cameron Bluff, it was not observed on the several other west-facing escarpments of this mountain.

[1] Research Paper No. 691. Journal Series, University of Arkansas.

Festuca dertonensis (All.) Aschers. and Graebn. Devil's Den State Park, near Winslow, Washington County, May 2, 1937, *Nielsen*, no. 4805.

Panicum pseudopubescens Nash. Doddridge, Miller County, July 23, 1938, *Nielsen.*

From vegetative material taken at Doddridge on November 11, 1937, and grown to maturity at the Agricultural Experiment Station, Fayetteville.

Sphenopholis filiformis (Chapm.) Vasey. Open prairie near Harrison, Boone County, June 5, 1937, *Nielsen*, no. 4946.

The writer acknowledges the services of Mrs. Agnes Chase and Mr. J. R. Swallen, Bureau of Plant Industry, U. S. Department of Agriculture, in the identification of the above species. The cited herbarium specimens have been deposited in the Herbarium of Agronomic Plants, Department of Agronomy, University of Arkansas.—Etlar L. Nielsen, University of Wisconsin.

THE ORTHOGRAPHY OF "PENSYLVANICUS"

Frank E. Egler

Fernald has twice drawn to the attention of the botanical world (Rhodora **19:** 70. 1917; Rhodora **42:** 94–95. 1940) the fact that Linnaeus, Lamarck, and others spelled with one "n" the specific epithet "*pensylvanicus*". The genera with species so named include: *Acer*, *Anemone*, *Avena* (*Trisetum*), *Cardamine*, *Carex*, *Myrica*, *Parietaria*, *Polygonum*, *Potamogeton*, *Potentilla*, *Prunus*, *Ranunculus*, *Saxifraga*, *Silene*, and *Vaccinium*.

Fernald (1940) upholds the Linnaean spelling for the following reasons: (1) The specific name *pensylvanicus* was consistently so written by Linnaeus and his contemporaries; (2) "maps of the 18th century generally show the spelling *Pensylvania*", and therefore (3) the early botanists "were not committing an orthographic error", but (4) "were following the authorized spelling of their day"; (5) "William Pen or Penn used both spellings [That the former was used was on the basis of a signature in Bellonius, *De Aquatilibus* (Paris, 1552), in the Harvard College Library. Professor S. E. Morison, of that institution, writes that the title page of this book has been torn and most of what was apparently the second 'n' has been lost]; Pepys, writing of him, used the first [Pen]".

Further investigation by the author does not change Fernald's recommendation, in line with the requirement of the International Rules of Botanical Nomenclature, that the spelling with one "n" should be adopted when originally so used; but it does reveal that some of Fernald's contentions for its acceptance may bear modification and elaboration. Furthermore, the one reason alone sufficient for adopting the Linnaean spelling, namely, Latinization of the word, has not heretofore been mentioned. The present author's reconsideration permits the following comments (numerically paralleling those listed above): (1) Linnaeus (1753) was consistent in the spelling of this word. Since no variants have been found, the orthography was certainly intentional. (2) Concerning the original spelling on maps, and not in complete agreement with Dr. Fernald, Mr. H. W. Shoemaker, State Archivist at the Pennsylvania State Library, Harrisburg, Pennsylvania, wrote (in a letter to Dr. J. S. Illick, New York State College of Forestry, Syracuse, New York, dated December 2, 1940) that "There is less agreement on the name of the province in the earlier years of its existence. It appears to have been spelled interchangeably with a single or a double "n" and with an "i" or a "y" in the second syllable. The Holme map, drawn about 1683, for example, has both "Pensilvania" and "Pennsylvania". The spelling "Pensylvania" also appears in several places, among others on the Pownall map of 1776". (3) It is unlikely, but certainly not impossible, that early botanists were committing an orthographic error. In any event, no spelling can be considered an error if it is one of several which had been in vogue, even if more than one were used in the same publication. (4) That the early botanists, as late as 1803, were following the authorized spelling of their day is not in agreement with Mr. Shoemaker's statement in the same letter that "On the whole, it would seem that there was no standard form for the name of the province in those early years, but that the present form gradually became the accepted one during the eighteenth century". "From an historical standpoint [Mr. Shoemaker continues, in a letter to the author, February 28, 1941] 'Pensilvania' is to be preferred to 'Pensylvania', since it was more commonly used. The spelling 'Pensylvania' was used much less frequently than either of the other variants." (5) In respect to

the spelling of the family name, Mr. Shoemaker writes in the earlier letter "there seems to be no authority whatever for any other form than 'Penn'. All the biographers of William Penn and his father agree on that spelling without mentioning any other, and the signatures of the Founder also show the double 'n' ". Prof. Morison adds the fact, however, in a letter of February 12, 1941, that "Gottfried Arnold, who wrote the first German biography . . . uses one 'n'. The name itself comes from the Welsh 'pen' meaning hill, and there is no doubt that it was originally spelled that way". Since the early botanists, nevertheless, named their plants after the province, not after the man, the spelling of the family name is actually irrelevant to the case at hand.

Apart from the more or less non-pertinent contentions listed above, and in full solution of the problem at hand, it is to be noted that in such Linnaean (1753, 1781) and Michauxian (1803) distribution phrases as "Habitat in Pensylvania", the Latin language is used throughout. According to Dr. P. O. Place and Dr. E. B. Lay of the Latin Department, Syracuse University, in the Latinization of such a word as Pennsylvania a second "n" tends to be dropped before a syllable beginning with a consonant, the "y" and the "i" are interchangeable, the former being a Greek influence and popular in mediaeval Latin, and the termination "icus" is an adjectival form meaning "belonging to". In conclusion, it appears that "pensylvanicus" is a correct Latinization of *any* of the several variants known in English during the 18th century, and as such should be freed of the vernacularization that illegitimately was imposed upon it by certain 19th century botanists.

New York State College of Forestry,
Syracuse, New York

EUPHORBIA SUBGENUS CHAMAESYCE IN CANADA AND THE UNITED STATES EXCLUSIVE OF SOUTHERN FLORIDA

Louis Cutter Wheeler

(*Continued from page 205*)

32. Euphorbia Fendleri T. & G., Rep. Expl. & Surv. Miss. R. to Pacific Ocean **2** (**4**): 175. 1855.

Glabrous perennial from a taproot woody in age; stems several to numerous from the base, decumbent to erect, up to 15 cm. long, slender, internodes up to 2 cm. long; leaf-blades entire, 3–11 mm. long, ovate-orbicular with oblique base, to lanceolate; petioles mostly ca. 1 mm. long; stipules up to 1 mm. long, distinct, narrowly linear, mostly entire, rarely with a few hairs; peduncles up to 4 mm. long, glabrous; cyathia solitary at the nodes; involucres glabrous, 1.25–1.75 mm. diam., campanulate to turbinate, glabrous without, with short hairs within above opposite the glands; lobes deltoid, shortly-attenuate, hairy within below, equaling the glands; glands reddish, 1.5–4 times as long as wide, concave or convex, up to 1 mm. long; appendages white, glabrous, 0.5–1 mm. long, as wide as the gland at least at the base, obtuse-crenate to entire and narrowly deltoid, or parted into 2–4 narrow segments; fifth gland shorter than the lobes, linear; sinus very broad and little depressed; bracteoles forming a single appendage adnate below to the involucre opposite each gland, 3–5-parted and hairy above; staminate flowers 5–7 per fascicle, 25–35 per involucre; androphores 1.25 mm. long, glabrous; gynophore glabrous, exserted and reflexed at maturity; ovary glabrous, three-lobed; styles glabrous, ca. 0.4 mm. long, bifid to the middle, curved upward, thickened at the base; capsule glabrous, three-angled, wider below, ca. 2.25–2.5 mm. long; seeds quadrangular, 2–2.25 mm. long, ca. 1 mm. radially, 1–1.2 mm. tangentially, ovate-acute radially, angles prominent, front facets concave, mostly smooth, back facets slightly wrinkled, coat white, microreticulate.

Key to Varieties

Plants decumbent to erect; leaves ovate-orbicular to ovate-lanceolate; appendages obtuse, crenate .... a. var. *typica*.
Plants erect and leaves lanceolate.
  Appendages narrowly deltoid, entire .... b. var. *chaetocalyx*.
  Appendages parted into 3–4 narrowly linear segments; roots very thick .... c. var. *triligulata*.

32a. E. Fendleri T. & G., Rep. Expl. & Surv. Miss. R. to Pacific Ocean **2** (**4**): 175. 1855, var. typica L. C. Wheeler, Bull. Torr. Bot. Club **63**: 444. 1936. Type: Santa Fe, New Mexico, May 4–July 18, 1847, *Fendler 800* (NY!; isotype G!, atypical).

See Plantae Exsiccatae Grayanae 726, cited below, for bibliography.—*Anisophyllum Fendleri* (T. & G.) Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 26. 1860.—*Chamaesyce Fendleri* (T. & G.) Small, Fl. Se. U. S., 710, 1333. 1903.

E. rupicola Scheele, Linnaea **22:** 153. 1849, not Boiss., Elench., 81. 1838. Type: "südlich von Neubraunfels: Lindheimer. Juli." (?). (*Lindheimer 290*, (M!) New Braunfels, Texas, July, 1846, designated as type collection by Blankinship, Ann. Rep. Mo. Bot. Gard. **18:** 149. 1907).

E. Fendleri T. & G. var. *dissimilis* Payson, Bot. Gaz. **60:** 379. 1915. Type: dry sandy hills, Naturita, Montrose County, Colorado, alt. 5,400 feet, June 27, 1913, *Payson 119* (Herb. University of Wyoming, Laramie; fragment W!; isotype G!, M!). Some of the plants unusually large-leaved and some of the appendages approaching those of var. *chaetocalyx*.

Chamaesyce Gooddingii Millsp., Field Mus. Pub. Bot. **2:** 405. 1916. Type: Lee Canyon, Spring (Charleston) Mountains, Clark County, Nevada, altitude 8,000 feet, Aug. 4, 1913, *A. A. Heller 11058* (F 411087!; photographs G!, W!; isotypes C!, G!, Ph!). A good representative of var. *typica*.

Chamaesyce Greenei (Millsp.) Rydberg *sensu* Rydberg, Fl. Rocky Mts., 544. 1917, and Fl. Pr. Plains, 517, fig. 350. 1932. The second includes some plants rather intermediate between var. *typica* and var. *chaetocalyx*. Plate 666C.

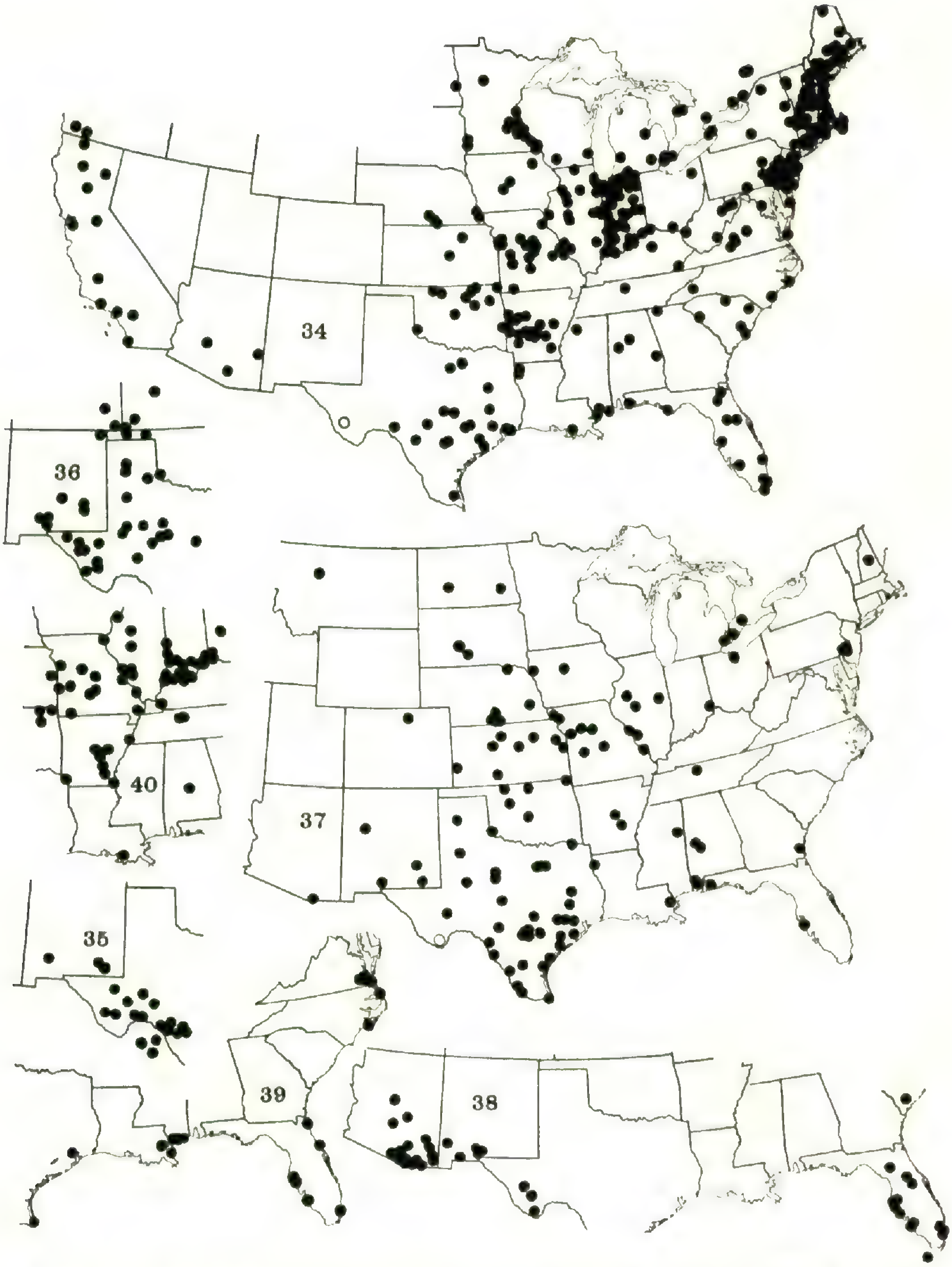
Inyo and San Bernardino Counties, California, east to western Nebraska and Oklahoma, south to Sonora (?), and Texas (Map 29). Representative specimens seen: Kansas. Ellis Co.: stony hills, *A. S. Hitchcock 475* (G). Oklahoma. Ellis Co.: near Shattuck, *Clifton 3183* (G). Woodward Co.: 8 miles southwest of Woodward, *Goodman 2179* (G). Roger Mills Co.: Antelope Hills, *Goodman 2612* (G). Harper Co.: near Buffalo, *G. W. Stevens 308* (G). Beaver Co.: 15 miles southwest of Beaver City, *G. W. Stevens 350* (G). Texas. Bexar Co.: 8 miles south of Bulverde, *Cory 6020* (G). Comal Co.: New Braunfels, *Lindheimer 104* (G). Wilson Co.: Sutherland Springs, 1879, *Ed. Palmer 1203* (G). Howard Co.: Big Springs, *Tracy 7852* (G, Mo). Hood Co.: rocky bluffs, June–Sept., ?, *Reverchon* (G). Taylor Co.: Buffalo Gap Hills, *Cory 8729* (G). Jeff Davis Co.: Davis Mountains, *Tracy 154* (G, Mo). Brewster Co.: 55.4 miles south of Alpine, *Cory 18595* (G). Presidio Co.: 15½ miles southwest of Marfa, *Cory 26319* (G). Kendall Co.: Spanish Pass, *Cory 19308* (G). Wyoming. Weston Co.: Newcastle, June 13, 1896, *Bates* (G). Colorado. Larimer Co.: *Cowen 126* (G). Weld Co.: Grassland, *Muir 82* (G). Mesa Co.: Grand Junction, *Macbride & Payson 694* (G). Montrose Co.: West Paradox, *Payson 2320* (G). Utah. Uintah Co.: 8 miles south of Ouray, Uinta Basin, *Rollins 1699* (G). Grand Co.: near Wilson Mesa, *Rydberg &*

Garrett 8382 (G). Emery Co.: Muddy River, 1877, *Ed. Palmer 443* (G). NEVADA. Clark Co.: Las Vegas, *Goodding 2282* (G). ARIZONA. Coconino Co.: Cosnino, *M. E. Jones 4036* (I, NY, O); desert near Tuba, *Clute 91* (G); Williams, July 12–14, 1886, *Bunker* (G); near Flagstaff, *MacDougal 209* (G, US). Yavapai Co.: near Montezuma Castle National Monument, *A. & R. Nelson 2048* (NY). Navajo Co.: Kayenta, *Clute 9* (G); Marsh Pass, *Eastwood & Howell 6616* (G). Cochise Co.: 5 miles northeast of Dragoon, *Maguire 11191* (G, I). For citation of additional specimens and discussion of intergrades see Bull. Torr. Bot. Club **63:** 445. 1936; Bull. So. Calif. Acad. **33:** 106. 1934; Bull. So. Calif. Acad. Sci. **35:** 128. 1936.

Certain plants of this species exhibit a rare tendency. They have occasionally three, four, or even five leaves at a node. The collection showing this tendency most strongly was one infected with rust: below Wheeler Well, rocky hillside, Juniper belt, Clark County, Nevada, May 31, 1936, *I. W. Clokey 7183* (Cl, G). These plants showed as many as five leaves per whorl. Another collection made at the same place and time which was not infected with rust had only opposite leaves: *Clokey 7184* (Cl). This suggested that the abnormality might have been induced by the pathogen. However another perfectly healthy collection from the same general region showed some whorled leaves: gravelly slope with *Juniperus* and *Cercocarpus*, Harris Springs Road, Spring (Charleston) Mountains, Clark Co., Nevada, July 16, 1937, *Clokey 7578, Pl. Exs. Gray. 726* (G). *MacDougal 209* (US) from Arizona also shows three leaves in a whorl in one rusty plant. That this variation is not confined to this region is shown by a collection which bears not only one whorl of four leaves but also one unpaired leaf. The collection bears only the data "*Rio Grande, Wright 1848*" (G).

Previously, Bull. Torr. Bot. Club **63:** 444. 1936, I made the error of combining the locality for Pope's collection from Big Springs of the Colorado River, Texas, with New Mexico, the state from which *Fendler 800* came.

32b. E. FENDLERI T. & G. var. CHAETOCALYX Boiss. in DC. Prod. **15** (**2**)**:** 39. 1862. TYPE: mountain sides near Frontera, El Paso County, Texas, Apr. 3, 1852, *C. Wright 1847* (Ge!; photographs G!, W!; ISOTYPE G!). Not the extreme of the variety but rather closer to *typica* but nevertheless acceptable in var. *chaetocalyx.—Chamaesyce chaetocalyx* (Boiss.) Wooton & Standley, Contr. U. S. Nat. Herb. **16:** 144. 1916.—*E. chaetocalyx* (Boiss.) Tidestrom, Proc. Biol. Soc. Wash. **48:** 40. 1935. PLATE 666D.



Map 34, dots range of Euphorbia supina, circle E. inopina; 35, E. acuta; 36, E. lata; 37, dots E. serpens in Canada & U. S., circle E. Golondrina; 38, E. hyssopifolia in U. S.; 39, E. ammannioides in U. S.; 40, E. humistrata (Virginian stations omitted).

Arizona, New Mexico, and western Texas (MAP 31). Representative specimens seen: TEXAS. Culberson Co.: *Cory 1964* (G). Crockett Co.: 11.9 miles southwest of Leon Powell, *Cory 3191* (G). Brewster Co.: Chisos Mountains, *Mueller 8077* (M). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 445. 1936.

Frontera seems to be missing on the modern maps. It is located on the Rio Grande a few miles above El Paso. It is shown on the general map, which is first, in the part entitled "Topographical Maps, Profiles, and Sketches", in Rep. Expl. & Surv. Miss. R. to Pacific Ocean. **11:**—1859.

32c. E. FENDLERI T. & G. var. TRILIGULATA L. C. Wheeler, Bull. Torr. Bot. Club **63:** 445. 1936. TYPE: cliffs above Boquillas Canyon, Boquillas, Brewster County, Texas, July 12, 1931, *Moore & Steyermark 3444* (G!; ISOTYPES CA!, D!, Ph!). A very distinctive variant known only from the type collection (MAP 29). PLATE 666E.

33. EUPHORBIA ASTYLA Engelm. ex Boiss. in DC. Prod. **15** (**2**): 40. 1862. TYPE: "Valley of the Nazas River" [Coahuila or Durango], Mexico, Apr. 15, 1847, *J. Gregg 457* (M 149805!; fragment F!; photographs G!, W!; probable isotype G!). A small but otherwise typical plant.—*Chamaesyce astyla* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 408. 1916.

Glabrous, perennial from a root up to 6 mm. thick; stems several to numerous, 4–23 cm. long, prostrate to erect, 0.6–2 mm. thick, internodes up to 2 cm. long but predominantly 3–6 mm. long; leaves sessile, 2–8 mm. long, orbicular-reniform to ovate-acute, base oblique, often clasping, margin entire: stipules united to form a scale ca. 0.5 mm. wide and mostly only ca. 0.2 mm. high, minutely lacerate and bearing a fringe of very short hairs on the inner margin; cyathia solitary at the nodes, mostly toward or at the stem-tips where often much congested by the very short internodes; peduncles 0.5–1.4 mm. long, stout; involucres glabrous outside, densely short-hairy inside especially at summit and somewhat downward beneath the glands, broadly campanulate to obconical-campanulate, 1.4–1.6 mm. in diam.; lobes narrowly triangular, equaling the glands; glands transversely oval to oblong, generally slightly depressed in the middle, 0.4–0.6 mm. long; appendages white, glabrous, ½–1½ times as wide as gland, entire or crenulate; 5th gland absent or present as a mere papilla; sinus U-shaped, not depressed, densely hairy; bracteoles numerous, glabrous below, pubescent above, ca. ⅔ as long as the androphores, some united below and often adnate to the involucre beneath the glands; staminate flowers 3–6 per fascicle, 22–26 per cyathium; androphores glabrous, 1.4–1.6

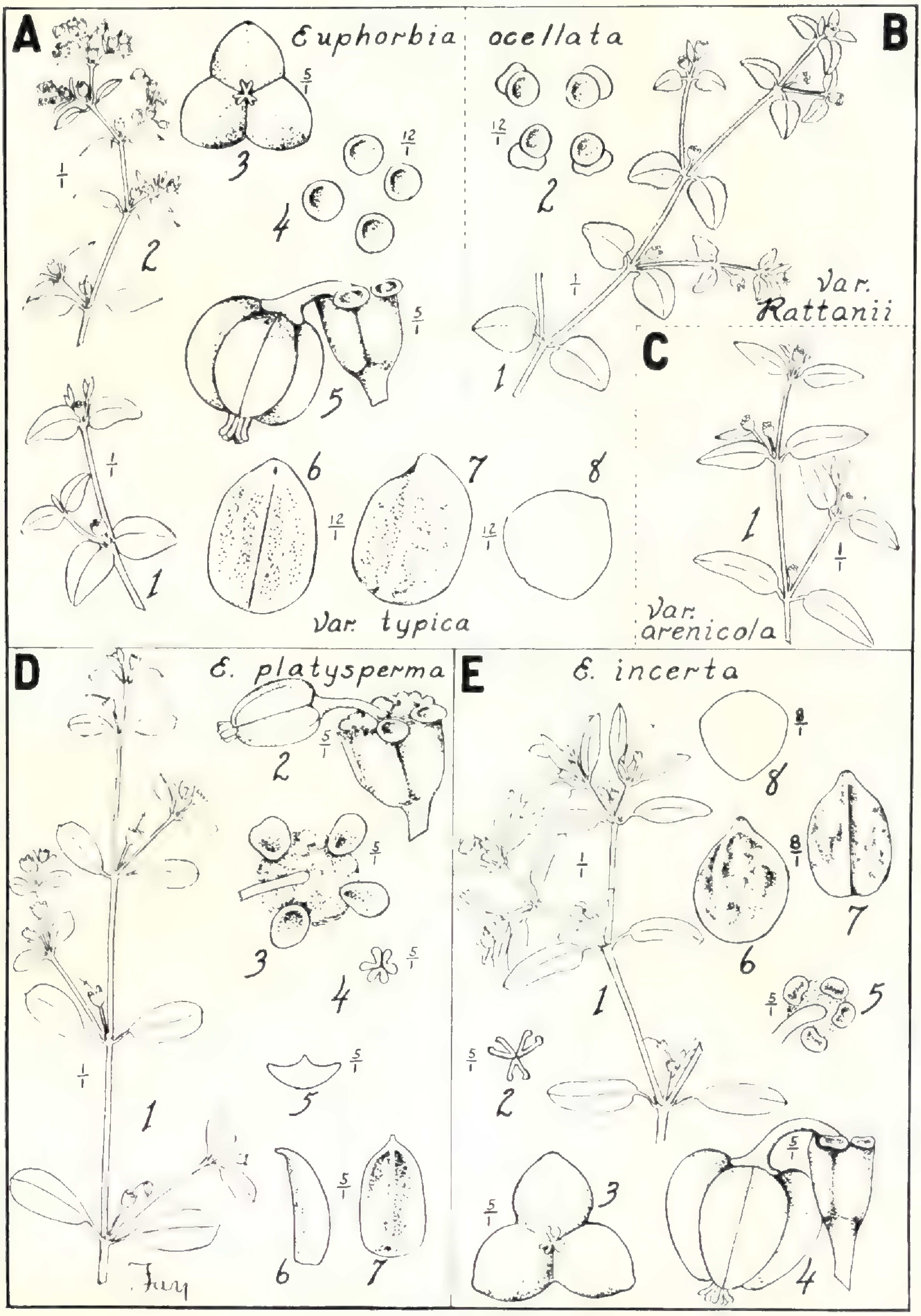
mm. long; gynophore glabrous, soon exserted and usually reflexed; ovary glabrous, 3-angled; styles 0.3–0.4 mm. long, entire, sometimes medianly creased, stigmas thickly round-capitate; capsule glabrous, subacutely 3-lobed, slightly wider below the equator, 1.9–2.6 mm. long, one carpel often sterile and shriveled; seeds sharply quadrangular, 1.5–1.7 mm. long, 0.9–1 mm. tangentially, 0.8–1 mm. radially, ovate radially, ventral facets plane to slightly convex, all traversed by irregular low rounded frequently anastamosing ridges separated by narrow grooves, angles often notched, gelatinous coat sordid to chalky white, very thick, microreticulate.—Plate 666A.

Rare and local in Coahuila and Durango (?), and in Pecos County, Texas (Map 33). Additional specimens seen: Texas: Pecos Co.: *Cory 1960* (G). MEXICO: Coahuila: 1 mile south of Hermanas, prostrate on heavy alkaline soil, *Johnston 7060* (G); 4 miles west of Cuatro Cienagas, middle of saline flats in very alkaline soil (with *Dondia, Allenrolfea, Atriplex,* etc.) prostrate, succulent, brittle, *Johnston 7135* (G); Sierra del Rey, *Purpus 4512* (F, G, M, US).

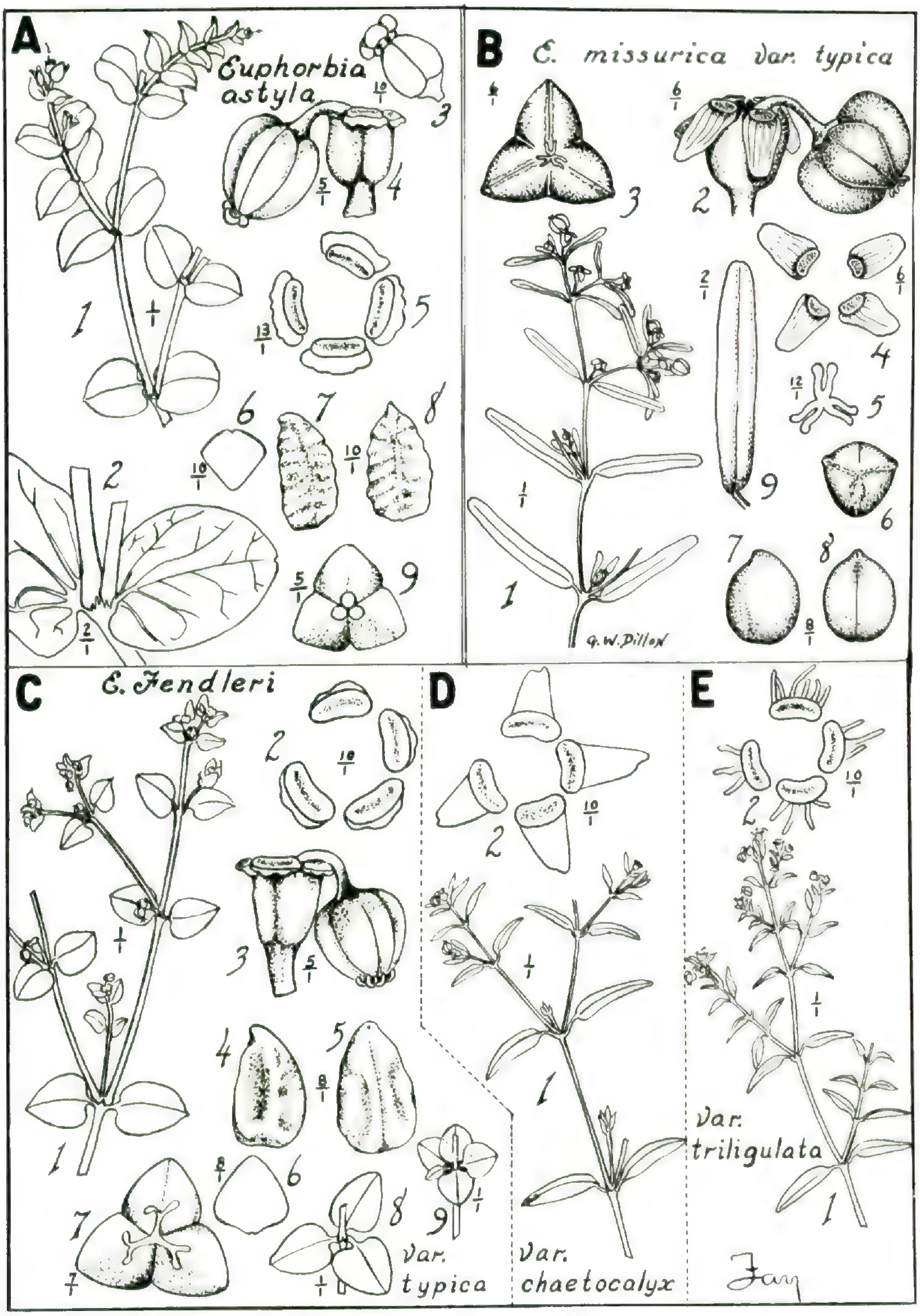
The collector's number on the type bears some illegible suffix and the notation that it was mixed with 457a.

34. Euphorbia Hooveri L. C. Wheeler, Proc. Biol. Soc. Wash. **53:** 9. 1940. Type: Yettem, Tulare County, California, June 30, 1937, *R. F. Hoover 2583* (G!; isotype W!).

Annual; stems prostrate or decumbent, to 20 cm. long, glabrous, from 1 mm. in diam. near the tips to as much as 3.5 mm. in diam. at the base, internodes as much as 1.5 cm. long, shorter toward the stem-tips; petioles ca. 0.5 mm. long; blades 2–5 mm. long, orbicular-cordate to orbicular-reniform, glabrous, papillate, margin with sharp white teeth; stipules united, white, deeply lacerate; peduncles ca. 0.5 mm. long; cyathia solitary in the axils; involucres 1.7–2 mm. in diam., campanulate, glabrous without and within except beneath the glands; lobes much exceeding the glands, narrowly deltoid, laciniate; glands transversely oval, ca. 0.5 mm. long, slightly cupped, at first red, then olive; appendages white, glabrous, parted into 3–5 ligules ca. 1 mm. long; 5th gland of 1 or 2 filiform segments equaling the lobes; sinus narrowly V-shaped, not depressed; bracteoles united only at the base, filiform, sparsely hairy, ca. ⅔ as long as the androphores, forming a radial row opposite each gland; staminate flowers 30–35 per cyathium, 6–7 per fascicle; androphores 2–2.1 mm. long, glabrous; gynophore glabrous, long-exserted and reflexed at maturity; ovary glabrous, 3-lobed; styles 1.7–2 mm. long, entire; capsule spheroid with flattened base, roundly 3-lobed, glabrous, 1.6–1.9 mm. long; seeds ovoid-quadrangular, rotund-ovate radially, raphe slightly curved,



Wheeler on Euphorbia



Wheeler on Euphorbia

back semi-circular, facets covered with low irregular, smooth ridges, 1.4–1.6 mm. long, 1–1.1 mm. tangentially and radially, coat white and microreticulate.—PLATE 664B.

Central Valley of California (MAP 32). Other collections seen: CALIFORNIA. Tulare Co.: Yettem, *R. F. Hoover 1277* (G). Tehama Co.: 4 miles southeast of Vina, *R. F. Hoover 3722* (G).

35. EUPHORBIA SERPYLLIFOLIA Pers., Syn. Pl. **2:** 14. 1806 (as *serpillifolia*).

Annual; stems glabrous to sparsely villous, prostrate to erect, 5–35 cm. long; leaf-blades 3–14 mm. long, ovate, oblong, oblong-cuneate, obovate, to narrowly oblong, linear-oblong, or oblong-lanceolate, often falcate, glabrous to sparsely villous, usually serrulate at least toward the apex; stipules distinct, linear, entire or few-parted, mostly glabrous; cyathia solitary; involucres glabrous to villous, 0.8–1.2 mm. in diam., obconical-campanulate to campanulate; glands transversely oblong, 0.2–0.5 mm. long; appendages narrow, white, glabrous, entire to crenulate or even subdentate; sinus U-shaped, slightly depressed; staminate flowers 5–18 per cyathium; androphores glabrous, 1–1.2 mm. long; gynophore glabrous, soon exserted and reflexed; capsule sharply 3-angled, 1.5–1.9 mm. long, wider below the equator, mostly glabrous; seeds quadrangular but often turgid, angles rounded to sharp, 1–1.4 mm. long, broadly ovate to narrowly ovate radially, facets smooth to slightly punctate or even rugulose, coat clay white to brown.

KEY TO VARIETIES

Glabrous throughout; leaves 3–14 mm. long . . . . a. var. *genuina*.
More or less villous; leaves 3–7 mm. long . . . . b. var. *hirtula*.

35a. E. SERPYLLIFOLIA Pers., Syn. Pl. **2:** 14. 1806, var. GENUINA Boiss. in DC. Prod. **15** (**2**): 43. 1862; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 444. 1917. TYPE: "Hab. in Amer. calidiore" (Ge?, not seen; fragment M!; photographs of fragment G!, W!). An average member of the species, stems slightly winged. Millspaugh, Pittonia 2: 82, Pl. 1, figs. 1–4. 1890, poor.—*Chamaesyce serpyllifolia* (Pers.) Small, Fl. Se. U. S., 712, 1333. 1903.

E. inaequilatera Sonder *sensu* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**): 187. 1859.

Anisophyllum novomexicanum Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 31. 1860. TYPE: "25th May–3rd Octbr. 1846–7. Rio del Norte, sandy soil, low river bank between rocks. Also: Santa Fe and Poñi Creek".[1] New Mexico, *Fendler 795* (B!; photographs G! W!). Stems very slightly winged; seeds slender, slightly punctately pitted. (This is not the extreme represented by *E. albicaulis*.)—*E. novomexicana* (Klotzsch & Garcke) L. C. Wheeler, Bull. So. Calif. Acad. Sci. **35:** 129. 1936.

[1] From Fendler's field notes (or copy?) at Gray Herbarium.

E. serpyllifolia Pers. β *consanguinea* Boiss. in DC. Prod. **15 (2):** 43. 1862. Type: Nebraska, 1853–4, *F. V. Hayden* (Ge!; photographs G!, W!). Stems slightly winged; seeds slender, punctately pitted; leaves mostly broad. While the seeds and capsules approach those of *E. albicaulis* the leaves are broader. Jepson, Fl. W. Middle Calif., 262. 1901.—*E. consanguinea*, *E. subserrata*, and *E. notata* Engelm. ex Boiss., l. c. in synonymy.—*Chamaesyce consanguinea* (Engelm.) Lunell, Amer. Midl. Nat. **1:** 205. 1910, with parenthetical author but without basinym; description given. Millsp., Field Mus. Pub. Bot. **2:** 408. 1916, basinym given as "*Euphorbia consanguinea* Engelm. Mex. Bound. 187". In that place no such name appeared. The name was first published by Boissier in synonymy; see above.

E. neomexicana Greene, Bull. Calif. Acad. Sci. **2:** 56. 1886. Type: plains toward the Gila, New Mexico, Aug., 1880, *E. L. Greene* (Herb. Greeneanum 13713, not seen; photograph G!). Narrow-leaved, other characters not certain from picture.—*E. serpyllifolia* var. *neomexicana* (Greene) Millsp., Pittonia **2:** 84, Pl. 1, figs. 16–18. 1890.—*Chamaesyce neomexicana* (Greene) Lunell, Amer. Midl. Nat. **1:** 205. 1910 (June), with parenthetical author but without basinym; description given. Standley, Contr. U. S. Nat. Herb. **13:** 199, 227. 1910 (Oct.), with basinym.

E. sanguinea Hochst. & Steud. *sensu* Greene, Bull. Calif. Acad. **2:** 56. 1886.

E. occidentalis Drew, Bull. Torr. Bot. Club **16:** 152. 1889. Type: Hy-Am-Pum, Trinity County, California, July 23, 1888, *Chestnut & Drew* (C!; isotype J!).—*E. serpyllifolia* var. *occidentalis* (Drew) Jepson, Fl. W. Middle Calif., 262. 1901.—*Chamaesyce occidentalis* (Drew) Millsp., Field Mus. Pub. Bot. **2:** 410. 1916.

E. serpyllifolia var. *rugulosa* Engelm. ex Millsp., Pittonia **2:** 85, Pl. 1, fig. 19. 1890. Type: San Bernardino Valley, Aug., 1881, *S. B. & W. F. Parish 672* (F 99060!; photographs G!, W!; isotype M!). Jepson, Fl. W. Middle Calif., 262. 1901.—*E. rugulosa* (Engelm.) Greene, Fl. Franciscana, 92. 1891.—*Chamaesyce rugulosa* (Engelm.) Rydb., Bull. Torr. Bot. Club **33:** 145. 1906.

E. albicaulis Rydb., Mem. N. Y. Bot. Gard. **1:** 266. 1900. Type: cultivated place south of Potter, Cheyenne County, Nebraska, July 13, 1891, *P. A. Rydberg 356* (NY!; photographs G!, W!). Stems terete; leaves very narrow; seeds long and slender.—*Chamaesyce albicaulis* (Rydb.) Rydb., Bull. Torr. Bot. Club **33:** 145. 1906.

Chamaesyce aequata Lunell, Amer. Midl. Nat. **1:** 204. 1910. Type: on a railroad bank, Leeds, Benson County, North Dakota, July 12, 1909, *J. Lunell 694* (Mi 251952!; photographs G!, W!).

Chamaesyce aequata var. *claudicans* Lunell, op. cit., 205. Type: on a railroad bank, Leeds, Benson County, North Dakota, July 27, 1909, *J. Lunell 695* (Mi 251953!; photographs G!, W!).

Chamaesyce erecta Lunell, op. cit., 206. TYPE: on the margin of a slough, Leeds, Benson County, North Dakota, Aug. 19, 1909, *J. Lunell 696* (Mi 251955!; photographs G! W!). Erect, as is often the case with plants of this species in wet situations.—*C. aequata* var. *erecta* (Lunell) Lunell, op. cit., **4:** 471. 1916.—PLATE 657C.

Southern British Columbia and Alberta, south to Mexico, east to western Texas, Colorado, Nebraska, Iowa, Minnesota, and northwestern Michigan (MAP 15). Said to be introduced into Europe. Representative specimens seen: ALBERTA: Rosebud Creek Valley, *Moodie 1199* in part (NY); Milk River, *Macoun 13702*[b] (O). BRITISH COLUMBIA: Vancouver Island, Sproat Lake, Aug. 12, 1887, *Macoun* (NY). MICHIGAN. Keweenaw Co.: July, 1888, *O. A. Farwell 235* (NY); Phoenix, June, 1886, *Farwell* (Ph); Keweenaw Point, July 15, 1885, *Farwell* (NY). MINNESOTA. Brown Co.: Sleepy Eye, *Sheldon 917* (Mi). Clay Co.: south of Moorhead, *Ballard 2902* (Mi). Kittson Co.: Northcote, *Ballard 2682* (Mi); Kennedy, *Ballard 2734* (Mi). Lincoln Co.: Lake Benton, *Sheldon 1285* (Mi). Marshall Co.: Warren, *Ballard 2774* (Mi). Pipestone Co.: Pipestone, Aug. 11, 1925, *Peterson* (Mi). St. Louis Co.: Duluth, *Lakela 2118* (Mi). IOWA. Monona Co.: Turin, *Pammel* (F). MISSOURI. Jackson Co.: Courtney, *Bush 11824* (Mo). NORTH DAKOTA. Benson Co.: Leeds, *Lunell 639* (Mi). Cass Co.: Fargo, July, 1890, *Greene* (NY). SOUTH DAKOTA. Brookings Co.: near Brookings, June 26, 1894, *T. A. Williams* (W). Stanley Co.: Fort Pierre, June 21, 1853, *Hayden* (NY). Washington Co.: Sheep Mt., *Visher 2359* (NY). NEBRASKA. Cheyenne Co.: south of Potter, *Rydberg 356* (NY). OKLAHOMA. Cimarron Co.: 11 miles north of Boise City, *Stratton 448* (M). TEXAS. Brewster Co.: Alpine, *MacKensen 38* (F). El Paso Co.: El Paso, *M. E. Jones 4342* (I). Culberson Co.: Van Horn flats, July, 1900, *Eggert* (M). MONTANA. Lake Co.: Aug., 1924, *Swingle* (I). WYOMING. Platte Co.: Uva, *Nelson 2743* (NY). Sweetwater Co.: Granger, *Nelson 8133* (NY). COLORADO. Boulder Co.: near Boulder, *Tweedy 5057* (NY). Conejos Co.: Antomito, July 19, 1898, *Earle* (NY). Denver Co.: Denver, along the Platte River, *M. E. Jones 864* (I). Douglas Co.: Buffalo Creek, *Goodman 2004* (NY). El Paso Co.: Manitou, July 27, 1888, *Northrop* (NY). Fremont Co.: Canyon City, *T. S. Brandegee 316* (Ph). Gunnison Co.: Parlin, *B. H. Smith 81* (NY). Jefferson Co.: Golden City, July, 1879, *Gaillardon* (F). La Plata Co.: Durango, *Baker, Earle & Tracy 608* (NY). Larimer Co.: Ft. Collins, July 10, 1896, *Baker* (NY). Otero Co.: 15 miles northeast of La Junta, *Rollins 1874* (M, NY, W). Ouray Co.: Box Cañon west of Ouray, *Underwood & Selby 156* (NY). Pueblo Co.: Pueblo, *Coulter* (F). NEW MEXICO. Chaves Co.: 20 miles south of Roswell, *Earle 273* (NY). Doña Ana Co.: Organ Mts., *Wooton 425* (NY). Grant Co.: Fort

Bayard, *Blumer 27* (NY). Lincoln Co.: near Gray, *Skehan 71* (NY); White Mts., *Wooton 608* (NY). Otera Co.: Cloudcroft, *Schulz 301* (NY). Sandoval Co.: 4 miles north of Bernalillo, *Arsène 18987* (F, US). San Miguel Co.: near Pecos, *Standley 5054* (NY). Santa Fe Co.: Santa Fe Canyon, 9 miles east of Santa Fe, *Heller 3845* (NY, O). Sierra Co.: 2 miles south of Hillsboro, *Metcalfe 1298* (NY). Idaho. Ada Co.: Boise, *Clark 144* (F). Bonner Co.: Lake Pend d'Oreille, Aug. 1, 1889, *Greene* (F). Shoshone Co.: Coeur d'Alene Mts., *Leiberg 1317* (NY). Canyon Co.: Falk's Store, *Macbride 724* (NY). Kootenai Co.: Lake Coeur d'Alene, *Epling & Hauch 10008* (M). Gem Co.: Sweet, *Macbride 1629* (NY). Utah. Juab Co.: Troutcreek, *Becraft & Starr 385* (I); 6 miles south of Callao, *Maguire & Richards 2685* (I). Beaver Co.: Beaver Canyon, *Garrett R2708* (NY). Carbon Co.: Price, *M. E. Jones 5467* (NY). Nevada. Elko Co.: near Blaine postoffice, *Heller 11118* (NY, Ph); near Fort Halleck, *Heller 9275* (NY). Ormsby Co.: Eagle Valley, *Baker 1274* (NY). Washoe Co.: Spanish Springs Valley, *Kennedy 1945* (F, NY). Arizona. Mohave Co.: Peach Spring, *Lemmon 39* (NY). Coconino Co.: Walker Lake, San Francisco Mts., *Knowlton 159* (F, US); Flagstaff, *M. E. Jones 3998* (I, O, US). Yavapai Co.: Clarksdale, *W. W. Jones 288* (G); 4 miles west of Prescott, *Wolf 2321* (G). Navajo Co.: Lakeside, White Mts., *Harrison 5517* (US). Apache Co.: north end of the Carrizo Mts., Navajo Indian Reservation, *Standley 7499* (US). Graham Co.: Solomonville, *Goodding 519* (G, NY, US). Gila Co.: Tonto Basin, *Toumey 266* (US). Cochise Co.: near Fort Huachuca, *Wilcox 328* (US); Portal, *Eggleston 10274* (US). Santa Cruz Co.: near Nogales, *Peebles, Harrison & Kearney 5565* (US). Washington. Klickitat Co.: North Dalles, *Thompson 11122* (NY). Okanogan Co.: Loomiston, *Elmer 602* (NY). Whitman Co.: Pullman, *Elmer 200* (NY). Oregon. Curry Co.: Rogue River bar at ferry, *Peck 13656* (Ph). Klamath Co.: Fort Klamath, *Peck 9562* (NY). Multnomah Co.: University Park, *Sheldon S.11309* (NY). Wallowa Co.: Hurricane Creek, *Sheldon 8630* (NY); Wallowa Mts., *Constance & Jacobs 1418* (NY). Wasco Co.: The Dalles, *Thompson 11891* (NY, W). Washington Co.: Forest Grove, July 2, 1894, *Lloyd* (NY). California. Humboldt Co.: Trinity River Valley near the South Fork, *Tracy 6555* (J). Mendocino Co.: Covelo Ranger Station, *Cronemiller 663* (J). Lake Co.: near Clear Lake, *J. Torrey 478* (NY). Sonoma Co.: Santa Rosa Creek east of Santa Rosa, *Heller 5802* (M, NY, Ph). Napa Co.: Napa River near St. Helena, *Jepson 13934* (J). Solano Co.: northeast of Elmira, *Jepson 12379* (J). San Francisco Co.: San Francisco, *Bolander 186* (NY). San Mateo Co.: Crystal Lake, *Abrams 2990* (NY). Santa Clara Co.: Stanford University, *Baker 195* (NY). Monterey Co.: Carmel,

1905, *Clemens* (NY). Siskiyou Co.: Mt. Shasta, *Brown 541* (NY). Shasta Co.: near Ash Creek, Shasta Forest, *Dayton 486* (NY). Butte Co.: 5 miles east of Chico, *Heller 13815* (F, NY). Colusa Co.: Indian Creek about 7 miles north of Leesville, *Bracelin 564* (I, NY). Sacramento Co.: Sacramento, *M. E. Jones 2855* (I). San Joaquin Co.: Lathrop, *Walker 910* (J). Alameda Co.: Berkeley, *Michener & Bioletti 6189* (M, NY). Modoc Co.: Egg Lake, July 25, 1893, *Baker* (J, NY). Lassen Co.: Beckwith Pass, *Jepson 7762* (J). Plumas Co.: Bucks Valley, *Jepson 10643* (J). Nevada Co.: lower end of Donner Lake, *Heller 6935* (NY). Placer Co.: Yuba River below Cisco, *Heller 13303* (NY, Ph). El Dorado Co.: near Echo Camp on Lincoln Highway, *Heller 12524* (NY, Ph, W). Amador Co.: Ione, *Braunton 1178* (NY). Calaveras Co.: Dorrington, *Jepson 10112* (J). Tuolumne Co.: Deadman Creek, *Jepson 6559* (J). Mariposa Co.: Yosemite Valley, *Abrams 4652* (NY). Madera Co.: Fresno Big Trees, *Jepson 15985* (J). Fresno Co.: Pine Ridge, *Hall & Chandler 345* (NY). Los Angeles Co.: Los Angeles, *Abrams 4178* (M, NY); Mescal Creek, San Antonio Mts., *Munz 7697* (NY); Canyon south of Avalon, Santa Catalina Island, *Pendleton 1398* (J). Orange Co.: Newport, May, 1908, *King* (J). San Bernardino Co.: Cucamonga, *Abrams 2661* (M, NY, Ph); Mill Creek, San Bernardino Mts., *Munz 7577* (NY); 5 miles south of Barnwell, eastern Mohave Desert, *Munz 13836* (W). San Diego Co.: San Diego, *Spencer 964* (NY). MEXICO: Baja California: northwest of La Encantada, Sierra San Pedro Mártir, *Wiggins & Demaree 5020* (US). Chihuahua: plains near Chihuahua, *Pringle 286* (Ph, US). Coahuila: Jimulco, *Pringle 81* (US). Durango: Durango, Apr.–Nov., 1896, *Ed. Palmer 899* (US). Querétaro: near San Juan del Rio, *Rose, Painter & Rose 9611* (US).

Bush's collection of this species from Missouri is not necessarily to be taken as evidence that the species grows there naturally. From this and several other collections of *Euphorbia* made by Bush at Courtney, his home town, I have been led to wonder if he were not careless with the sweepings from his herbarium and consequently found many waifs in his backyard.

Euphorbia minuta Philippi appears doubtfully distinct from *E. serpyllifolia*.

It is quite possible that the plants here called *E. serpyllifolia* var. *genuina* could be divided into three varieties: (1) The typical with broad leaves and seeds; (2) slender-seeded, narrow-leaved, ranging from Nebraska to New Mexico and perhaps westward in arid regions; (3) elliptic-leaved and with numerous staminate

flowers and subdentate appendages, in the Central Valley of California.

35b. E. SERPYLLIFOLIA Pers. var. HIRTULA (Engelm.) L. C. Wheeler, Proc. Biol. Soc. Wash. **53:** 11. 1940; based on *E. hirtula* Engelm. ex S. Wats., Bot. Calif. **2:** 74. 1880. TYPE: Talley's, Cuyamaca Mountains, San Diego County, California, 1875, *Ed. Palmer 451* (G!; ISOTYPE M!). Jepson, Man. Fl. Pl. Calif., 599. 1925; Munz, Man. So. Calif. Bot., 287. 1935.—*Chamaesyce hirtula* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 409. 1916; Davidson & Moxley, Fl. So. Calif., 219. 1923.

Mostly in the pine belt, central Sierra Nevada, south Coast Ranges, San Bernardino, San Jacinto, and Cuyamaca Mountains, California, south to northern Lower California (MAP 14). Representative specimens seen: CALIFORNIA. Nevada Co.: Bear Valley, *Jepson 13924* (J). Mariposa Co.: Cedar Brook, Sierra Nevada, *Jepson 15964* (J); Agua Fria, Mariposa, *Congdon 75* (G). Monterey Co.: Santa Lucia Mountains, *Vasey 576* (G); along San Antonio River between Jolon and Santa Lucia Ranger Stations, *Mason 5789* (G); bridge over Salinas River at Bradley, *Mason 5506* (G); San Miguelito Rancho, Jolon, Santa Lucia Mountains, *Jepson 1650* (G); Jolon, Sept. 22, 1894, *Eastwood* (G); Jolon, Aug., 1885, *T. S. Brandegee* (G). San Bernardino Co.: Bear Valley, margins of Pine Lake, *Abrams 2952* (G); San Bernardino Mountains, 1880, *Nevin* (G). Riverside Co.: Idyllwild, San Jacinto Mountains, June 16, 1921, *Spencer* (O); Idyllwild, San Jacinto Mountains, June 26, 1920, *Spencer* (O); San Jacinto Mountains, *Spencer 970* (G). San Diego Co.: Pine Valley, June 10, 1917, *Spencer* (O); Julian, *Cleveland 904* (G); San Diego, 1874, *Cleveland* (G, M); near Julian, *Abrams 3789* (G). MEXICO: LOWER CALIFORNIA, San Vincente Rancho, July 8, 1896, *T. S. Brandegee* (J).

The designation of the specimen at Gray Herbarium as type seems necessary in view of the following evidence: Two collections are cited, "Near San Diego (*Cleveland*); at Talley's in the Cuyamaca Mountains, *Palmer*." Engelmann, on the sheet in his herbarium, questioned the reference of the Cleveland collection to *E. hirtula*. That means that Engelmann considered the name associated permanently with the Palmer collection. No sheet has been found at Missouri Botanical Garden which can appropriately be taken as type. The isotype at M was acquired after Engelmann's death by purchase of a private herbarium. Engelmann's Latin diagnosis was sent to Watson and now reposes in the folder of *E. hirtula*. Watson translated the description into English and published it for Engelmann.

Jepson, Fl. Calif. **2:** 426. 1936, took the Cleveland collection as type but that was done without examining the actual specimens. Jepson has confused certain specimens of *E. supina* (as *E. maculata*) with this species, e. g., *Jepson 10,042.*

At US there is a collection by *Ed. Palmer* in 1869 bearing only the locality "Sonora". The label is copied. In view of the curiously restricted range of this species it is fairly certain that this locality is erroneous.

36. Euphorbia glyptosperma Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**)**:** 187. 1859. Type: Fort Kearney on the Platte River, Kearney County, Nebraska, July, 1856, *H. Engelmann* (M 144635!; photographs G!, W!; isotype? G!). (See Rhodora **39:** 496. 1937 for discussion of this choice.) An average member of the entity. Boiss., Icon. Euph., t. 18. 1866, poor.—*Chamaesyce glyptosperma* (Engelm.) Small. Fl. Se. U. S., 712, 1333. 1903.

E. glyptosperma Engelm. var. *tenerrima* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**)**:** 187. 1859. Type: pebbly bars of the Nueces River, Texas, May 25, 1851, *C. Wright 1853* (M 144673!; photographs G!, W!; isotypes G!, NY!). A plant with small leaves, a character which shows no geographical correlation, completely intergrades and is probably more ecological than genetical.

E. glyptosperma Engelm. var. *pubescens* Boiss. in DC. Prod. **15** (**2**)**:** 48. 1862. Type: bord du Mississippi, Illinois, *Riehl 472* (Ge, not seen; fragment F!). A mixture of typical *E. glyptosperma* with *E. humistrata*. The first element is taken as type.—*Chamaesyce glyptosperma pubescens* (Boiss.) Millsp., West Va. Geol. Surv. **5** (A)**:** 294. 1913 (Living Fl. W. Va.).

E. Greenii Millsp., Pittonia **2:** 88. 1890. Type: Beaver Canyon, Idaho, July 30, 1889, *E. L. Greene* (F 196395!, photographs G!, W!). Entirely typical and later abandoned by its author.—*Chamaesyce Greenei* (Millsp.) Rydb., Fl. Rocky Mts., 544, 1063. 1917.

Chamaesyce glyptosperma Engelm. var. *integrata* Lunell, Amer. Midl. Nat. **3:** 142. 1913. Type: Leeds, Benson County, North Dakota, Aug. 20, 1906, *J. Lunell 693* (Mi 251964!, photographs G!, W!). Entire leaves are by no means unusual in this species and the character is too variable to warrant recognition.

Annual, glabrous; stems mostly prostrate, sometimes ascending or erect, 5–33 cm. long, 0.5–1.5 mm. thick, internodes up to 3 cm. long, average ca. 1 cm.; leaf-blades prevailingly oblong to narrowly oblong, often subfalcate, but varying to ovate and ovate-oblong in the lower, 3–15 mm. long, base strongly inequilateral, margin often serrulate especially at the apex and on the

lower margin; petioles ca. 1 mm. long; stipules subulate, long-attenuate into a filiform tip, up to 2 mm. long, glabrous, with a few linear, erect lateral divisions below; peduncles 0.5–2 mm. long; cyathia solitary at the nodes; involucre obconical, tapering to the peduncle, 0.6–0.9 mm. in diam., glabrous outside, glabrous inside except on lower margin of lobes; lobes triangular, shortly attenuate, slightly exceeding the glands; glands transversely elliptical to oblong, 0.15–0.4 mm. long, mostly depressed in the middle; appendages white, glabrous, 1–1½ times as wide as the glands, bluntly crenulate-dentate to subentire; fifth gland nearly glabrous, of 1 or sometimes 2 filiform segments, equaling or slightly exceeding the lobes; sinus narrowly U-shaped, slightly depressed; bracteoles reduced to one filiform segment adnate below to the involucre opposite each gland, free portion entire to deeply parted, about equaling the androphores, bearing a few minute hairs above, or glabrous; staminate flowers 1–5, but most commonly 4, per cyathium; androphores 0.9–1 mm. long, glabrous; gynophore glabrous, soon exserted and usually reflexed; ovary glabrous, subacutely 3-lobed; styles spreading, becoming erect only in age, the tips erect and slightly clavate, ca. 0.3 mm. long; ca. ⅓ bifid; capsule glabrous, sharply 3-angled, wider below the equator, 1.4–1.7 mm. long; seeds sharply quadrangular, 1–1.3 mm. long, 0.7–0.9 mm. tangentially and radially, radially ovate, base truncate, ventral facets concave, dorsal convex, both traversed by 3 to 4 rounded transverse ridges passing more or less through the angles, or sometimes the ridges very faint, coat microreticulate, white to tan.—Plate 660B.

New Brunswick and Quebec, west to British Columbia, south to Indiana, Missouri, and Texas, northwest from New Mexico to northern California and Oregon (Map 24). Representative specimens seen: New Brunswick: Carleton Co.: yard of the Canadian Pacific railroad, Hartland, *Fernald 1981* (G). Quebec: Pontiac Co.: Chichester, Vallée de l'Ottawa, *Marie-Victorin, Rolland-Germain & Meilleur 44015* (G). Lake Deschênes above Aylmer, *Macoun 87830* (G). Ontario: east of London, Sept. 23, 1911, *Dearness* (G, NY); Stilleville, *Macoun 87829* (G); Amherstburg, *Macoun 88092* (G); Thunder Bay District, near Jack Fish, *Pease & Bean 23435* (G). Saskatchewan: along railroad near Saskatoon, *Macoun & Herriot 76824* (NY); Carlton House, *Richardson* (M). Alberta: Fort Saskatchewan, *Turner 66* (W); Calgary, *Macoun 24720* (NY); Rosedale, Rosebud Creek Valley, *Moodie 1199* (G, M). British Columbia: Lake Osoyyos, *Macoun 79546* (NY); flood plain of Columbia at Beavermouth, *Shaw 1146* (G, NY); Vancouver Island, Aug. 15, 1921, *Carter* (G). Maine. Aroostook Co.: Fort Fairfield, *Fernald 1980* (G, NE). Oxford Co.: Rumford, Aug. 1, 1890, *Parlin* (NE). New Hampshire. Coös Co.: Randolph, *Pease 18138* (NE); Carroll at

Carroll Station, *Pease 16591* (NE). VERMONT. Franklin Co.: Swanton, *Blake 3158* (NE). Chittenden Co.: Burlington, Aug. 7, 1921, *Knowlton* (G). Windsor Co.: Mt. Tom, Woodstock, Aug. 3, 1933, *Kittredge* (G). NEW YORK. Washington Co.: northeast of Tripoli, Sept. 19, 1915, *Burnham* (G, NY). Albany Co.: Albany, *House 25024* (NY). Suffolk Co.: Fishers Island, Aug. 11, 1895, *Graves* (NY). MICHIGAN. Schoolcraft Co.: near Manistique, *Dodge 201* (NY). Emmet Co.: Pellston, *Deam 28949A* (Deam). Dickinson Co.: south of Iron Mountain, *Fernald & Pease 3407* (G). Kalamazoo Co.: 6 miles west of Schoolcraft, *Hanes 1886* (G). INDIANA. Steuben Co.: Bass Lake, 5 miles west of Angola, *Deam 55400* (Deam, G). Elkhart Co.: 3 miles northeast of Bristol, *Deam 57370* (Deam, G). Newton Co.: Beaver Lake bed, 3 miles south of Lake Village, *Deam 56707* (Deam). WISCONSIN. Brown Co.: Green Bay, Aug. 4, 1887, *Schuette* (NY). Waupaca Co.: Lake Mendota, Marion, Aug. 21, 1893, *Sudworth* (NY). Trempealeau Co.: Brady Peak, 1 mile west of Trempealeau, *Hermann 8944* (NY). La Crosse Co.: La Crosse, *Pammel 620* (G). Dane Co.: Madison, Aug. 13, 1889, *Trelease* (M). Polk Co.: Osceola, Aug. 8, 1900, *Baker* (G). Pierce Co.: Prescott, *Fassett 10258* (G). ILLINOIS. Cook Co.: on ballast, West Chicago, *Umbach 2313* (G). Lee Co.: Dixon, *Vasey* (G). Peoria Co.: Peoria, July, 1891, *McDonald* (G). St. Clair Co.: St. Louis, Sept., 1886, *Eggert* (NY). MINNESOTA. Anoka Co.: *Cooper 111* (Mi). Becker Co.: Detroit Lakes, *O. A. Stevens 290* (G). Brown Co.: Sleepy Eye, *Sheldon 5966* (Mi). Carver Co.: Chaska, *Ballard 161* (Mi). Chisago Co.: Center City, *Taylor 1568* (Mi). Clay Co.: Muskoda, *Ballard 3051* (Mi). Chippewa Co.: Montevideo, Aug. 28, 1893, *Moyer* (Mi). Clearwater Co.: near Squaw Lake, *Moyle 850* (Deam, NY). Crow Co.: Brainerd, *Mell 249* (M, NY). Houston Co.: Jefferson, *W. A. Wheeler 434* (Mi). Hennepin Co.: Minneapolis, *Sheldon 1658* (Mi). Kandiyohi Co.: Spicer, *Frost 347* (Mi). Kittson Co.: Humboldt, *Ballard 2604* (Mi). Lincoln Co.: Lake Benton, *Sheldon 1557* (Mi). Morrison Co.: *Sandberg 888* (Mi). Ottertail Co.: Clitherall, July, 1897, *Campbell* (Mi). Pipestone Co.: Pipestone City, 1892, *Menzel* (Mi). Pope Co.: Glenwood, *Taylor 784* (Mi). St. Louis Co.: tree nursery bed, Duluth, *Lakela 1563* (NY). Scott Co.: Cleary's Lake, *Ballard 527* (Mi). Winona Co.: July, 1886, *Holzinger* (Mi). IOWA. Boone Co.: Ledges, *Pammel & Ball 191* (G, NY). Black Hawk Co.: *Burk 904* (M). Green Co.: Rippey, July 31, 1867, *Allen* (G). Woodbury Co.: Sioux City, *Pammel 193* (G, NY). Humboldt Co.: Dakota City, *Pammel 190* (G, NY). MISSOURI. Jackson Co.: Courtney, *Bush 500* (NY). NORTH DAKOTA. Renville Co.: Pleasant, July 28, 1912, *Lunell* (NY). Towner Co.: Maza, May 10, 1900, *Kildahl* (Mi). Ramsey Co.: Devil's Lake, *Lunell 692* (Mi). Oliver Co.:

Ft. Clark, upper river valley on old Indian Lodge site, *O. A. Stevens 384* (F, G). Billings Co.: Medora, Aug. 12, 1896, *Brannon* (Mi). Stark Co.: Dickinson, *Bergman 690* (O). Richland Co.: Swan Lake, Hankinson, *Metcalf 156* (NY). South Dakota. Walworth Co.: Mobridge, Missouri River bottom, *Moyer 687* (NY). Potter Co.: Forest City, June 9, 1892, *Griffith & Schlosse* (O). Spink Co.: near Redfield, *Ricksecker 81* (O). Kingsbury Co.: Iroquois, Aug., 1892, *Thornber* (G). Meade Co.: Faith, *Moyer 205* (NY). Lawrence Co.: Deadwood, *Rydberg 77* (G, NY). Fall River Co.: Hot Springs, Black Hills, *Rydberg 992* (G, NY). Washabaugh Co.: Bear Creek, *Visher 2022* (NY). Mellette Co.: White River, July 5, 1896, *Wallace* (NY). Pennington Co.: 5 miles south of Scenic, *Hayward 569* (NY). Todd Co.: Rosebud Creek, *Wallace 121* (NY). Nebraska. Cherry Co.: Snake River Hardlands, *Tolstead 621* (G). Hooker Co.: on Middle Loup River, near Mullen, *Rydberg 1373* (G, NY). Thomas Co.: on Middle Loup River, *Rydberg 1742* (G, NY). Scott's Bluff Co.: Kuoa Valley, *Rydberg 355* (NY). Custer Co.: Broken Bow, *Webber 7* (NY). Deuel Co.: sand-draws, *Rydberg 197* (NY). Lancaster Co.: Lancaster, *Clements 2587* (NY). Dawes Co.: 10 miles south of Chadron, *Tolstead 806* (G). Franklin Co.: Franklin, *Laybourn 48* (M). Kearney Co.: Minden, July 29, 1930, *Hapeman* (O). Webster Co.: Red Cloud, *Bates 2988* (G). Kansas. Comanche Co.: west of Protection, *E. J. Palmer 41860* (NY). Ellis Co.: near Hays, *Rydberg & Imler 1252* (NY). Geary Co.: Ft. Riley, *Gayle 576* (NY). Graham Co.: Bogue, *Imler 65* (NY). Grant Co.: Ulysses, *Thompson 2* (G, NY). Kiowa Co.: Belvidere, Sept. 5, 1898, *White* (NY). Osborne Co.: south Fork Solomon River, 5 miles of Osborne City, *Shear 183* (G). Riley Co.: Prairie, *Norton 470* (G, NY). Wyandotte Co.: Quindaro, Aug. 30, 1896, *Mackenzie* (NY). Oklahoma. Alfalfa Co.: near Cherokee, *G. W. Stevens 1779* (G, M). Comanche Co.: Fort Sill, July 20, 1891, *Sheldon* (M). Harmon Co.: Hollis, *G. W. Stevens 1055* (G, M). Kingfisher Co.: Huntsville, May 26, 1896, *L. A. Blankinship* (G, O). Logan Co.: near Guthrie, *G. W. Stevens 3277* (G). Murray Co.: Davis, Arbuckle Mountains, *Demaree 12827* (NY). Muskogee Co.: Arkansas Junction, *Bush 533* (G, NY). Woods Co.: near Fairvalley, *G. W. Stevens 1641* (G, M, NY). Texas. Brown Co.: *Reverchon 765* (G). Crane Co.: 11 miles east of Grand Falls, *Cory 27315* (G). Dallas Co.: Dallas, June, 1874, *Reverchon* (G). El Paso Co.: El Paso, *M. E. Jones 4195* (NY). Hall Co.: Estelline, *Reverchon 3789* (G). Menard Co.: Menard, *Cory 24700* (G). Nueces Co.: near Corpus Christi, Mar., 1894, *Heller* (NY). Presidio Co.: Marfa, *Havard 16* (M). Randall Co.: Palo Duro Canyon, *Ball 1257* (NY). Reeves Co.: Verhalen, *Cory 1956* (G). Tarrant Co.: low woods, *Ruth 304* (NY). Taylor Co.: Abilene, *Tracy 7861* (G,

NY). Tom Green Co.: 3 miles east of San Angelo, *Cory 4879* (G). Victoria Co.: Guadalupe, 105 miles southwest of San Antonio, 1879, *Ed. Palmer 1201* (G). Wilbarger Co.: Chillicothe, *Ball 959* (NY). Wilson Co.: Sutherland Springs, 1879, *Ed. Palmer 2047* (G). MONTANA. Lewis and Clark Co.: near Helena, Aug. 12, 1892, *Kelsey* (NY). Park Co.: Suksdorf Gulch, 9 miles west of Wilsall, *Suksdorf 86* (G). Yellowstone Co.: Custer, *J. W. Blankinship 116* (M). WYOMING. Teton Co.: Spread Creek, *Tweedy 368* (NY). Crook Co.: Devil's Tower, Little Missouri Butte, Aug. 17, 1897, *Griffiths & Carter* (NY). Johnson Co.: South Fork of Powder River, *Goodding 257* (G, NY). Converse Co.: Orin Junction, *Nelson 2573* (G, NY). Yellowstone National Park, *G. N. Jones 5285* (NY). COLORADO. Weld Co.: New Windsor, *Osterhout 2369* (NY). Larimer Co.: Ft. Collins, July 9, 1896, *Baker* (M, NY). Boulder Co.: near Boulder, *Tweedy 5058* (NY). Denver Co.: near Denver, Sept. 25, 1916, *Rehder* (G). El Paso Co.: Manitou, *F. E. & E. S. Clements 25* (M, NY). Fremont Co.: Canyon City, *Clements 276* (NY). Pueblo Co.: Pueblo, *Baker, Earle & Tracy 5* (G, NY, O). Montrose Co.: Naturita, *Payson 510* (G, Ph). Ouray Co.: near Ouray, *Underwood & Selby 240* (NY). Archuleta Co.: Arboles, *Baker 453* (G). UTAH. Box Elder Co.: Brigham, *Zundel 242* (NY). Cache Co.: 3 miles northeast of Logan, *Maguire 208* (I). Morgan Co.: Peterson, Weber River, Devil's Gate, *Pammel & Blackwood 3911* (G, M). Salt Lake Co.: Salt Lake City, *M. E. Jones 1024* (I, NY). Grand Co.: Moab, *Christinsen 10039* (NY). Uintah Co.: near Jensen, *Peirson 12599* (G). San Juan Co.: near Bluff, along San Juan River, *Rydberg & Garrett 9897* (NY). NEVADA, 1872, *Wheeler* (NY). NEW MEXICO. Rio Arriba Co.: Española on the Rio Grande above Santa Fe, Sept. 7, 1881, *Engelmann* (M). Guadalupe-San Miguel Co.: between Anton Chico & Las Vegas, *Rose & Fitch 17620* (NY). Doña Ana Co.: Doña Ana, *C. Wright 1855* (G, NY). ARIZONA. Apache Co.: Navajo Indian Reservation, north end of Carrizo Mountains, *Standley 7371* (US). Navajo Co.: Holbrook, Oct. 4, 1897, *Zuck* (US). Coconino Co.: Houserock, *Eastwood & Howell 6473* (G). IDAHO. Nez Perces Co.: Lake Waha, *Heller 3343* (NY). OREGON. Multnomah Co: Hayden Island, *Thompson 3749* (M). Wasco Co.: The Dalles of the Columbia, Aug. 2, 1880, *G. Engelmann* (M). Wallowa Co.: Horse Creek Canyon, *Sheldon 8114* (NY). Grant Co.: 4 miles east of John Day, *Peck 18612* (NY). WASHINGTON. Okanogan Co.: Palmer Lake, Loomiston, *Elmer 602* (M). Chelan Co.: Peshastin, Wenatchee Valley, *Sandberg & Leiberg 472* (G, NY). Stevens Co.: Marcus, *Kreager 461* (G, NY). Pierce Co.: Murray, American Lake, *Muenscher 5103* (G). Walla Walla Co.: Waitsburg, *Horner 1161* (G). Klickitat Co.: White Salmon, *Suksdorf 489* (G).

This species ranges the farthest north of any species of *Euphorbia* in North America. It nearly reaches 54° north latitude at Fort Saskatchewan, Alberta. On the other extreme it ranges south to the Gulf of Mexico in Texas.

I was under the impression that I had seen specimens from California in some of the herbaria in that state. None of my notes confirm this and only one Californian specimen has been found in the more than three hundred collections examined and that had atypical seeds and foliage: Shasta Co., along the Sacramento River, but in dry ground, near Redding, Sept. 4, 1889, *Greene* (F). Plants nearly intermediate between *E. glyptosperma* and *E. serpyllifolia* occur on the southern slopes of Mt. Shasta.

The plants referred to *E. glyptosperma* by Jepson, Man. Fl. Pl. Calif., 599. 1925, were probably *E. Abramsiana.* The fact that *E. glyptosperma* does not appear in Jepson, Fl. Calif. **2:** —. 1936, supports this supposition.

There are two other collections sufficiently different to merit comment. *Eastwood & Howell 6473* from Arizona has unusually narrow seeds, thus approaching *E. Abramsiana.* *Suksdorf 86* from Montana has unusually large seeds.

37. Euphorbia Abramsiana L. C. Wheeler, Bull. So. Calif. Acad. Sci. **33:** 109. 1934. Type: Heber, Imperial Valley, Imperial County, California, June, 1904, *LeRoy Abrams 4097* (D33555!; isotypes G!, M!, Ph!). *E. pediculifera* Engelm. var. *Abramsiana* (L. C. Wh.) Ewan in Jepson, Fl. Calif. **2:** 427. 1936. *Chamaesyce saltonensis* Millsp. in Parish, Cat. Pl. Salton Sink, 6. 1913 (preprint from Carn. Inst. Wash. Pub. **193:** 110. 1914); nomen nudum based on *Parish 8302 & 8305 q. v. infra.*

Annual; stems prostrate or rarely ascending, few to several, finely pubescent to rarely completely glabrous, slender (mostly not over 1 mm. thick), to 25 cm. long, internodes to 3 cm. long but mostly much shorter, gradually shortening upward; leaf-blades shortly puberulent to glabrous, 2–12 mm. long, ovate-oblong, oblong, elliptic-oblong, or the uppermost sometimes elliptic-lanceolate, base inequilateral, apex obtuse, margin often strongly revolute at least on drying, sometimes some of the larger serrulate at the apex and on the lower margin; petioles ca. 1 mm. long; stipules distinct, less than 0.5 mm. long, the upper usually 2–3-parted, the lower several-parted, with a few cilia or glabrous; peduncles to 1 mm. long, glabrous; cyathia solitary at the nodes but mostly congested in groups of 5 to 10 on very short leafy lateral branches; involucres 0.6–0.7 mm. in diam., glabrous outside, glabrous inside except on the lobes, obconical, tapering

to the peduncle; proximal lobes greatly exceeding the glands, each deeply parted into 2–4 slender glabrous segments, the distal lobes exceeding the glands, mostly parted into 2 slender glabrous segments, all the lobes with a few hairs inside at the base; fifth gland equaling the glands, filiform, glabrous; sinus narrowly V-shaped, little depressed, making the fifth gland appear somewhat as one of the divisions of the lobes; glands transversely elliptic to subcircular, 0.15–0.2 mm. long; appendages mostly wider than the glands, white, glabrous, entire or slightly two-lobed; bracteoles reduced to one slender segment opposite each gland, adnate to the involucre below, free portion of one or two slenderly filiform segments about equaling the androphores, with a few short hairs; staminate flowers 3–5 per cyathium; androphores glabrous, 0.7–0.9 mm. long; gynophore glabrous, exserted but often not reflexed; ovary glabrous, 3-lobed; styles bifid ca. halfway, glabrous, clavate, ca. 0.3 mm. long, rotately spreading but the tips slightly ascending; capsule glabrous, rotundly ellipsoid-oblong, 1.3–1.7 mm. long, subacutely 3-angled; seeds sharply quadrangular, 1–1.4 mm. long, 0.6–0.7 mm. tangentially, ca. 0.6 mm. radially, narrowly ovate to oblong-ovate radially, base truncate, ventral facets slightly concave, dorsal facets plane or slightly convex, all with 4–6 irregular transverse rounded ridges slightly including the angles, coat white, microreticulate.—PLATE 660D.

Colorado Desert, California, southern Arizona, south to northern Sinaloa (MAP 1). Representative specimens seen: CALIFORNIA. Imperial Co.: streets of Brawley, about 15 feet below sea-level, *Parish 8305* (F, G, J); old beach east of Calexico, about 2 feet below sea-level, *Parish 8302* (G, J, NY). ARIZONA. Yavapai Co.: Fort Verde, *MacDougal 511* (US); Fort Verde, *Mearns 155* (NY). Maricopa Co.: 20 miles south of Gila Bend, *Harrison, Kearney & Fulton 7991* (A, US). Pinal Co.: Sacaton, *Peebles, Harrison & Kearney 83* (US), *Peebles 10595* (US); weed in greenhouse, experiment farm, Sacaton, *Peebles 5834* (A). Pima Co.: on range reserve, Wilmot, *Thornber 342* (M, US); among rocks, Papago Reservation, *Harrison & Kearney 7993* (A, US). Co.?: "Mesas," June 23, 1881, *Pringle* (NY, US). MEXICO: SONORA: Guaymas, low sandy places, Sept., 1887, *Ed. Palmer 186* (G, US); Guaymas, high gravelly ridges, Sept., 1887, *Ed. Palmer 187* in part (G, US). SINALOA: dry hills, Fuerte, *Rose, Standley & Russell 13541* (US). For citation of additional specimens see Bull. So. Calif. Acad. **33:** 110. 1934.

The specimens from Fort Verde are atypical in that they have coarser stems with coarser pubescence, and seeds approaching those of *E. glyptosperma* which is the closest relative of this species.

38. Euphorbia **theriaca** sp. nov. Annua, glabra; caulibus prostratis vel suberectis; laminis foliorum ovatis, obovatis, vel ovato-orbicularibus, 3–5 mm. longis, integris; petiolis 0.7–1 mm. longis; cyathiis solitariis; involucris turbinato-campanulatis, diametro 1.3–1.4 mm.; glandulis transverse ovalibus vel oblongis, 0.6–0.8 mm. longis; appendiculis nullis vel rudimentis tantum; floribus masculis 30–36 per cyathium; stylis bifidis, 0.3–0.4 mm. longis; capsulis glabris, subacute 3-angulatis, 1.4–1.6 mm. longis; seminibus acute quadrangularibus, 1–1.2 mm. longis, in quoque latere 2–3 rugis transversis praeditis, radialiter ovato-acutis, basi truncatis.

Glabrous annual; stems prostrate to suberect, 0.5–1.4 mm. thick, internodes up to 2 cm. long but mostly about 1 cm. long; leaf-blades ovate or obovate to ovate-orbicular, 3–5 mm. long, margin entire, apex rounded or sometimes emarginate; petioles 0.7–1 mm. long; stipules 0.7–1 mm. long, ventral mostly united, dorsal sometimes united, linear-subulate, mostly entire, margin sparsely ciliate; cyathia solitary at the nodes; peduncles 0.3–0.7 mm. long; involucre turbinate-campanulate, 1.3–1.4 mm. in diam., 1.7–2 mm. long, glabrous outside, with short hairs at the summit and beneath the glands inside; lobes triangular, acuminate to obtuse, slightly exceeding the glands, with short hairs on the margin and inner face; glands 0.6–0.7 mm. long, transversely oval to oblong; appendages absent or a mere linear swelling beneath gland; fifth gland ca. ⅔ as long as the lobes, linear; sinus U-shaped, not depressed; bracteoles forming a radial partition adnate halfway up the involucre below each gland, parted into few to several shortly hairy linear segments above; staminate flowers 6–8 per fascicle, 31–36 per cyathium; androphores 1.4–1.7 mm. long, glabrous or very rarely with a few short hairs; gynophore glabrous, soon exserted and reflexed; ovary glabrous, strongly but roundly 3-lobed; styles 0.3–0.4 mm. long, slightly clavate, bifid to the middle or below; capsule glabrous, 1.4–1.6 mm. long, slightly broader than long, strongly and subacutely 3-lobed; broader below the equator, base truncate; seeds tetragonal, 1–1.2 mm. long, 0.7–0.8 mm. tangentially and radially, ovate-acute radially, base truncate, facets with mostly 3, sometimes 2, high rounded ridges passing but slightly through the sharp angles, coat white, microreticulate.—Plate 660A.

Type: Blue Creek, Chisos Mountains, Brewster County, Texas, Aug. 1, 1931, *C. H. Mueller 8080* (G!).

This same number at M, NY, and US consists wholly of *E. cinerascens.* There was a little bit of this mixed with the collection at G. This number at F contains a few fragments of *E. theriaca*, the rest is *E. cinerascens.* Known only from the type. (Map 7).

39. Euphorbia arizonica Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**)**:** 186. 1859. Type: Arizona (without further locality) Nov., 1856, *A. Schott* (M 46906!, fragment F!, photographs F!, G!, W!). A young erect plant with large leaves.—*Chamaesyce arizonica* (Engelm.) Arthur, Torreya **11:** 260. 1911.

E. versicolor Greene, Bot. Gaz. **6:** 184. 1881. Type: San Francisco Mountains near Clifton, Greenlee County, Arizona, Sept. 3, 1880, *E. L. Greene* (Herb. Greeneanum, Notre Dame; photograph G!; isotype NY!). About an average member of the species.—*Chamaesyce versicolor* (Greene) Norton, Contr. U. S. Nat. Herb. **25:** 345. 1925.

E. portulana S. Watson, Proc. Amer. Acad. Arts & Sci. **24:** 73. 1889. Type: island in harbor, Guaymas, Sonora, Mexico, Oct., 1887, *Ed. Palmer 321* (G!; isotype C!).—Stems unusually rigid and numerous.—*Chamaesyce portulana* (S. Wats.) Millsp., Field Mus. Pub. Bot. **2:** 411. 1916.

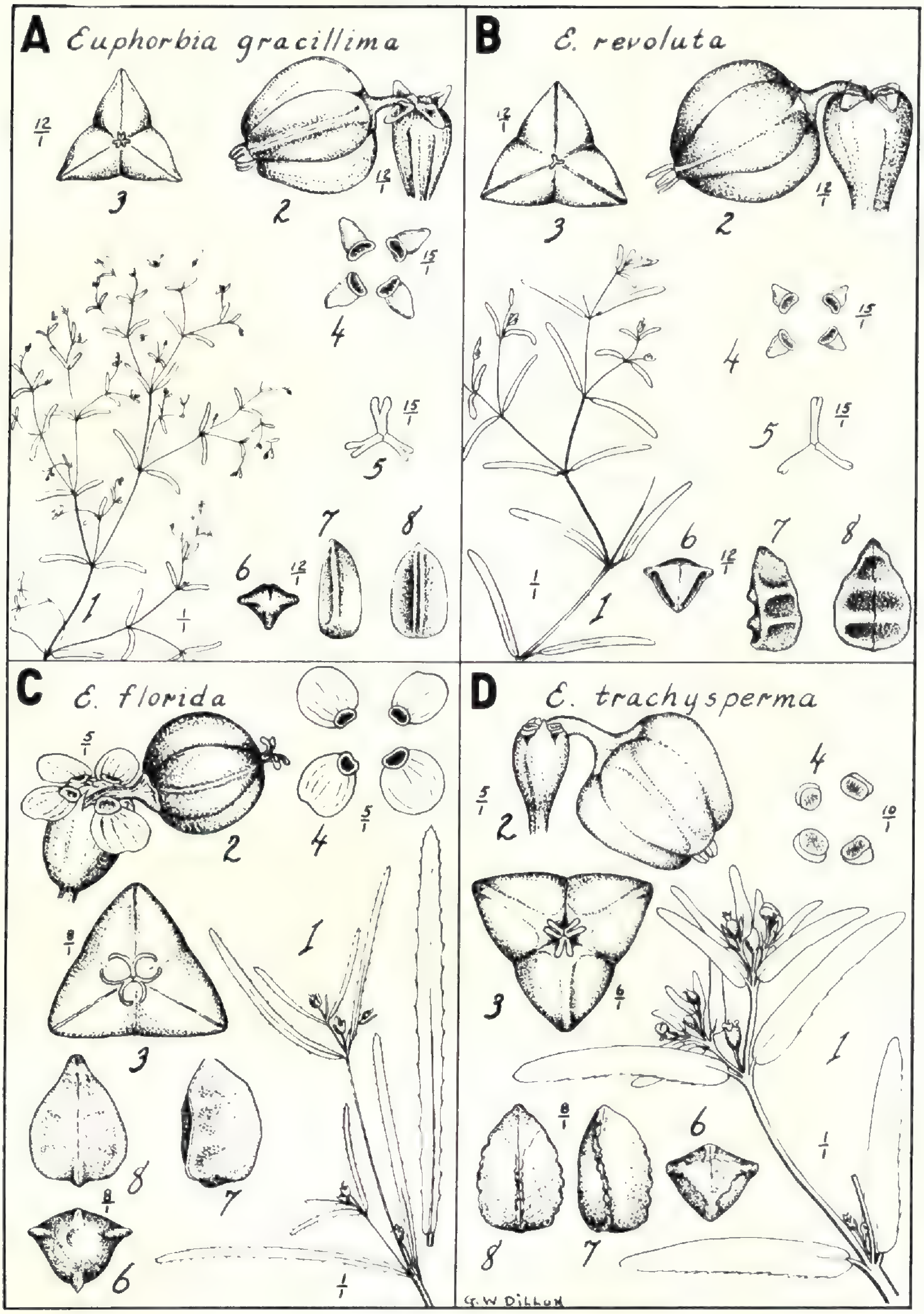
E. purisimana Millsp., Proc. Calif. Acad. Sci., ser. 2, **2:** 225. 1889. Type: Purisima, Lower California, Mexico, Feb. 12, 1889, *T. S. Brandegee* (F 196127!; photographs G! W!; isotype C!). Unusual in that the glands on most, but not all, of the involucres lack appendages.—*Chamaesyce purisimana* (Millsp.) Millsp., Field Mus. Pub. Bot. **2:** 411. 1916.

E. collina T. S. Brandegee, Univ. Calif. Pub. Bot. **4:** 184. 1911 (not Philippi, Linnaea **29:** 41. 1857–8). Type: Cerro de San Ignacio, Durango, Mexico, July, 1910, *C. A. Purpus 4599* (C 144767!; fragment F!; isotypes F!, G!, M!). An entirely typical member of the species.

Perennial from a woody taproot, erect or prostrate, sometimes forming mats; stems up to 30 cm. long, slender, with fine, spreading, mostly clavate, microscopically smooth hairs, internodes up to 3 cm. long, generally shorter, often very short towards the ends of the branches; leaf-blades reddish, 1–10 mm. long, deltoid-ovate, ovate, ovate-oblong with oblique base, or the upper very small and oval-cuneate, mostly with fine spreading hairs at least on the lower surface, margin entire, petioles 1–2 mm. long, clothed as the leaves; stipules minute and often not visible, lower united, upper distinct; peduncles filiform, with fine spreading hairs, 1–4 mm. long, mostly 1–2 mm. long; cyathia solitary at the nodes but often congested by the shortening of the upper internodes; involucres long-turbinate, constricted above, ca. 1.5 mm. long, 0.8 mm. diam., with sparse short spreading hairs without, glabrous within; lobes subulate, equaling the glands, entire, ciliate on the margins; glands 1.5–2 times as long as wide, 0.3–0.4 mm. long, concave, red; appendages glabrous, oval, up to 1 mm. long, white but rubescent; fifth gland absent, its sinus narrowly V-shaped and depressed halfway to base of the involucre; bracteoles reduced to one sparsely hairy filiform appendage

adnate below to the involucre opposite each gland, two-thirds as long as the involucre or shorter; staminate flowers 5–10 (or rarely 12), mostly 6–7; androphores glabrous, equaling the glands, 1.5 mm. long; gynophore glabrous, long-exserted and reflexed at maturity; ovary three-lobed, densely pubescent, styles parted to the middle, slender, glabrous, ca. 0.6 mm. long; capsule with spreading hairs, spheroid with flattened base, ca. 1.5 mm. long and in diam., obtusely three-angled; seeds quadrangular, 1–1.2 mm. long, ca. 0.6 mm. radially and tangentially, base truncate, outline narrowly ovate radially, raphe obliquely truncated by the micropylar region, facets with low, often anastomosing, ridges which slightly include the angles, white coat very thin, the brown testa showing through.—Plate 661B.

Colorado Desert, California, south to Lower California, east to Texas, Chihuahua, and northern Durango (Map 43). Representative specimens seen: California. San Diego Co.: Palm Canyon, Borrego Valley, *Templeton 1632* (Lam, P). Riverside Co.: Andreas Canyon, Palm Spring region, *Peirson 4256* (Peir). Arizona. Yuma Co.: near Quartzsite, *Kearney & Peebles 10215* (US); Palm Canyon, S. H. Mountains, *Peebles & Loomis 6755* (US). Coconino Co.: Phantom Ranch, Bright Angel Creek, Grand Canyon, Nov. 16, 1935, *Collom* (US); Shinumo Creek, Grand Canyon, Oct. 21–26, 1906, *Pilsbry* (Ph). Maricopa Co.: Cave Creek, north of Phoenix, *Peebles, Harrison & Kearney 3685* (US). Pinal Co.: near Superior, *Kearney & Peebles 9213* (US). Pima Co.: Sierra Tucson, April 27, 1884, *Pringle* (NY); Baboquivari Mountains, *Kearney & Peebles 10395* (US); rocky south slopes, north of Ranger Station, Baboquivari Mountains, *Wiegand, Maguire, Richards & Moeller 10761* (G, I). Santa Cruz Co.: Tumacacori, *Harrison & Kearney 6021* (G, US). Greenlee Co.: disturbed soil at side of Highway 81 on Smelter Hill, south of Clifton, west exposure, *Maguire, Richards & Moeller 11780* (G, I). Graham Co.: east exposed slopes, Upper Creosote Zone, Peloncillo Mountains, 20 miles east of Safford, *Maguire, Richards & Moeller 10642* (I); Coolidge Dam, *Kearney & Smith 9029* (US). New Mexico. Doña Ana Co.: Peña Blanca, 1903, *Wooton* (P). Texas. El Paso Co.: El Paso, Sept. 11, 1885, *M. E. Jones* (I, O, US). Brewster Co.: Persimmon Gap, Santiago Mountains, *Cory 6906* (G); frequent on talus, 14 miles east of Castolon, *Cutler 664* (G); frequent along creek-bed at base of Lone Mountain, Chisos Mountain area, *Warnock 657* (US). MEXICO: Baja California: in wash north of flying field, near Santa Rosalia, *Ferris 8699* (NY, US); head of Concepcion Bay, *J. N. Rose 16696* (G, NY, US). Chihuahua: Candelaria, *E. Stearns 245* (US); 11 miles northeast of Camargo, crevices on face of lava cliff, *Johnston 7917* (G). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 416. 1936.



WHEELER on EUPHORBIA

A. EUPHORBIA CHAMAESYCE L. Photograph of type from Jamaica, *P. Browne* (Linnaean Herb.). B. EUPHORBIA MACULATA L. Photograph of type, source and collector unknown (Linnaean Herb.). Photographs by courtesy of Section of Photography, Field Museum of Natural History.

My previous statement, l. c., as to type locality and type collection was based on confusion resulting mainly from the fact that I had not seen Engelmann's specimens. Now it is clear that the specimen taken as type here is the one which should be and has been taken as type by Millspaugh. There is a specimen of this species purporting to have as its origin Warm Springs, Mohave Desert, San Bernardino County, California, May, 1882, *S. B. & W. F. Parish 1384* (M 144655). But this is the type collection of *E. Parishii.* Another sheet of the same collection (M 144654) is *E. Parishii.* Since 144655 is the only specimen of *E. arizonica* claiming to have come from Mohave Desert and since it appears that a mixture may have occurred in the mounting, I question the source of 144655.

40. Euphorbia setiloba Engelm. ex Torrey, Rep. Expl. & Surv. Miss. R. to Pacific Ocean **5** (**2**): 364. 1857. Type: Fort Yuma, Imperial County, California, *Major G. H. Thomas* (NY!; isotype M!). A biologically typical member of the species.—*Chamaesyce setiloba* (Engelm.) Millsp. ex Parish, Cat. Pl. Salton Sink, 6. 1913 (preprint from Carn. Inst. Wash. Pub. **193:** 110. 1914).

E. floccosiuscula M. E. Jones, Contr. West. Bot. **15:** 145. 1929. Type: Hermosillo, Sonora, Mexico, Oct. 27, 1926, *M. E. Jones 22739* (P!; isotype M!). A plant with unusually long internodes, apparently from a shady situation.

Annual, with microscopically smooth tapering hairs throughout; stems slender, prostrate or perhaps rarely erect, rarely forming mats, internodes up to 2 cm. long, often much shortened toward the stem-tips congesting the leaves and involucres into dense small "heads"; leaf-blades 2–7 mm. long, oblong or oblong-ovate, base slightly oblique, petioles up to 1 mm. long; stipules not apparent; peduncles up to 1.5 mm. long, clothed as the herbage, filiform; cyathia solitary at the nodes; involucres very shortly hairy without, glabrous within, long-turbinate, constricted above, ca. 1.2 mm. long, ca. 1 mm. in diam.; lobes narrowly deltoid, entire, ciliate, equaling the glands; glands red, transversely oblong or the distal sometimes discoid, concave, 0.1–0.2 mm. long; appendages white, glabrous, ca. 1 mm. long and wide, parted into 3–5 narrow attenuate segments; fifth gland totally absent, its sinus depressed halfway to base of the involucre; bracteoles reduced to one filiform appendage adnate below to the involucre opposite each gland, with few or no hairs, free portion only ca. 0.2 mm. long; staminate flowers 3–7 per cyathium; androphores glabrous, ca. 1.2 mm. long, ca. equaling the glands; gynophore glabrous or with a few hairs above; ovary three-

lobed, long-white-hairy, styles glabrous, 0.4–0.5 mm. long, parted to the base, clavate, slender; capsule long-hairy, spheroid, ca. 1.1 mm. long, sharply angled, seeds 0.9–1 mm. long, ca. 0.6 mm. radially and tangentially, quadrangular, sharply angled, facets with low irregular wrinkles, base truncate, ovate-acutish radially, coat microreticulate, white but the brown testa showing through. —Plate 661A.

Deserts of California from Inyo County south to San Diego and Imperial Counties, southern Nevada, western and southern Arizona, Gila River Valley in New Mexico, east to western Texas, south to Baja California and Sinaloa (Map 19). Representative specimens seen: California. Inyo Co.: Funeral Mountains, *Coville & Funston 333* (US). San Diego Co.: sandy soil, upper end of San Felipe Wash, *J. T. Howell 3255* (M). Arizona. Yuma Co.: near Quartzsite, *Kearney & Peebles 10213* (US). Pima Co.: fenced area, Santa Rita Forest Reserve, *Griffiths 6080* (M, US). Cochise Co.: sandy washes, Fort Lowell, *Thornber 180* (M, NY). New Mexico. Grant Co.: gravel beds along the Gila, *E. L. Greene 265* (M). Texas. Brewster Co.: frequent on flats between Nugent Mountain and Lone Mountains, *Warnock T562C* (US); infrequent at Persimmon Gap, *Warnock T553* (US). MEXICO: Baja California: Agua Verde, *J. N. Rose 16574* (US). Sonora: in sand on river bank, Chorijoa, Rio Mayo, *Gentry 1609* (F, G, US): hillside 9 miles north Magdalena, *Wiggins 6194* (US). Sinaloa: Fuerte, *Rose, Standley & Russell 13540* (US). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 429–430. 1936.

The specimen at M, which it would seem might well be taken as type, is too fragmentary.

41. Euphorbia villifera Scheele, Linnaea **22:** 153. 1849. Annual, or definitely perennial in some Mexican specimens: stems erect, 6–45 cm. tall, pilose with long white tapering hairs, or rarely glabrous, epidermis papillate, papillae disappearing in age, internodes mostly 1–2 cm. long, ultimate branchlets often subcapillary; leaf-blades ovate to triangular-ovate-acute, often falcate, 3–10 mm. long, uppermost often much reduced and narrower, mostly glabrate above, usually pilose beneath, epidermis papillate beneath, base usually strongly inequilateral, margin entire to coarsely serrate; petioles ca. 1 mm. long, strongly amplexicaul; stipules 0.5–1 mm. long, distinct to wholly united, mostly attenuate and often with erect linear divisions, mostly glabrous; peduncles mostly glabrous, 1–2 mm. long; cyathia solitary at the nodes and terminal; involucre campanulate, 0.9–1 mm. in diam., glabrous or occasionally with sparse short spreading hairs outside, pubescent at the summit inside; lobes triangular, acuminate, hairy inside, about equaling the

glands; glands transversely elliptical to oblong, 0.3–0.5 mm. long, depressed or slightly folded in the middle; appendages 1–3 times as wide as and mostly a little longer than the glands, white, glabrous, margin entire to crenulate; fifth gland linear, ½–⅔ as long as the lobes; sinus small, U-shaped, little depressed; bracteoles partly free and partly united into a radial partition adnate for ca. ⅔ its length to involucre, somewhat shallowly divided above, pubescent above, nearly equaling the androphores; staminate flowers 9–25 per cyathium; androphores glabrous, ca. 0.9 mm. long; gynophore glabrous, exserted and mostly reflexed; ovary glabrous, sharply 3-angled; styles glabrous, ca. 0.4 mm. long, ⅓–½ bifid; capsule glabrous, sharply 3-angled, the angles often produced beyond the seed into an empty carina, 1.3–1.9 mm. long, 2.6–3.2 mm. in diam.; seeds ovoid-quadrangular, 1–1.1 mm. long, 0.7–0.9 mm. tangentially and radially, radially ovate, subacute, back and lateral angles sharp, facets convex, smooth to faintly and broadly wrinkled, coat light brown to white, subfarinose and microreticulate.

Key to Varieties

Herbage more or less pilose . . . . a. var. *typica*.
Herbage glabrous . . . . b. var. *nuda*.

41a. E. villifera Scheele, Linnaea **22:** 153. 1849, var. **typica.** Type: New Braunfels, Comal County, Texas, Aug.–Sept., 1846, *F. Lindheimer 293* (?; isotype M 200497!). (This collection designated as type by Blankinship, Ann. Rep. Mo. Bot. Gard. **18:** 149. 1907.) A good representative of the species, some of the leaves slightly toothed.—*Chamaesyce villifera* (Scheele) Small, Fl. Se. U. S., 712, 1333. 1903.

Chamaesyce Stanfieldii Small, l. c. Type: San Marcos and vicinity, Hays County, Texas, summer, 1898, *S. W. Stanfield* (NY!; photographs G!, W!). Leaves mostly entire, good match for isotype of *E. villifera.*—*E. Stanfieldii* (Small) Cory, Rhodora **38:** 407. 1936.—Plate 659D.

Texas, south to Oaxaca, Yucatan, and Guatemala (Map 16). Representative specimens from the United States: Texas. Hays Co.: San Marcos and vicinity, summer, 1898, *Stanfield* (NY); San Marcos, spring, 1897, *Stanfield* (NY). Travis Co.: Mt. Bonell, Austin, *Hall 550* (M, NY); Mt. Bonell, near Austin, *Young 50* (G, M); southwest of Austin, *Rose & Russell 24111* (NY). Comal Co.: near New Braunfels, *Plateau 5447* (NY); New Braunfels, 1846–1851, *Lindheimer 294* (M), *308* (G, M), *508* (G, M), *1148* (G, NY), *1149* (G, NY); New Braunfels, 1850, *C. Wright* (M, NY). Kerr Co.: 5.8 miles southeast of Mountain Home, *Cory 19310* (G); 13¾ miles southwest of Kerrville, *Cory 23954* (G). Real Co.: 16 miles north of Bandera, *Cory 8898* (G);

16¼ miles north of Leakey, *Cory 24387* (G); 14.7 miles north of Leakey, *Cory 27404* (G). Brewster Co.: Blue Creek, Chisos Mountains, *Cory 7006* (G); Blue Creek Trail, Chisos Mountains, *Cory 7329* (G); Chisos Mountains, *Mueller 8081* (G, NY); in basin of Chisos Mountains, *Warnock C646* (US); Glass Mountain, *Warnock T202* (US).

This species is exceedingly variable in habit and margin of the leaf. The distinction attempted by Small when he separated this species into two, one with leaves entire or essentially so and the other with leaves serrate, is useless since it would divide the species in such a way that there would be more intermediates than members of the two extremes. Furthermore, Small's type was far from typical of the supposed entity he attempted to define.

Lindheimer 293 is one of the numbers combined and distributed as Fasc. III 530. *Warnock T202* is atypical in having styles ca. 0.7 mm. long, 33–34 staminate flowers, and a woody perennial root.

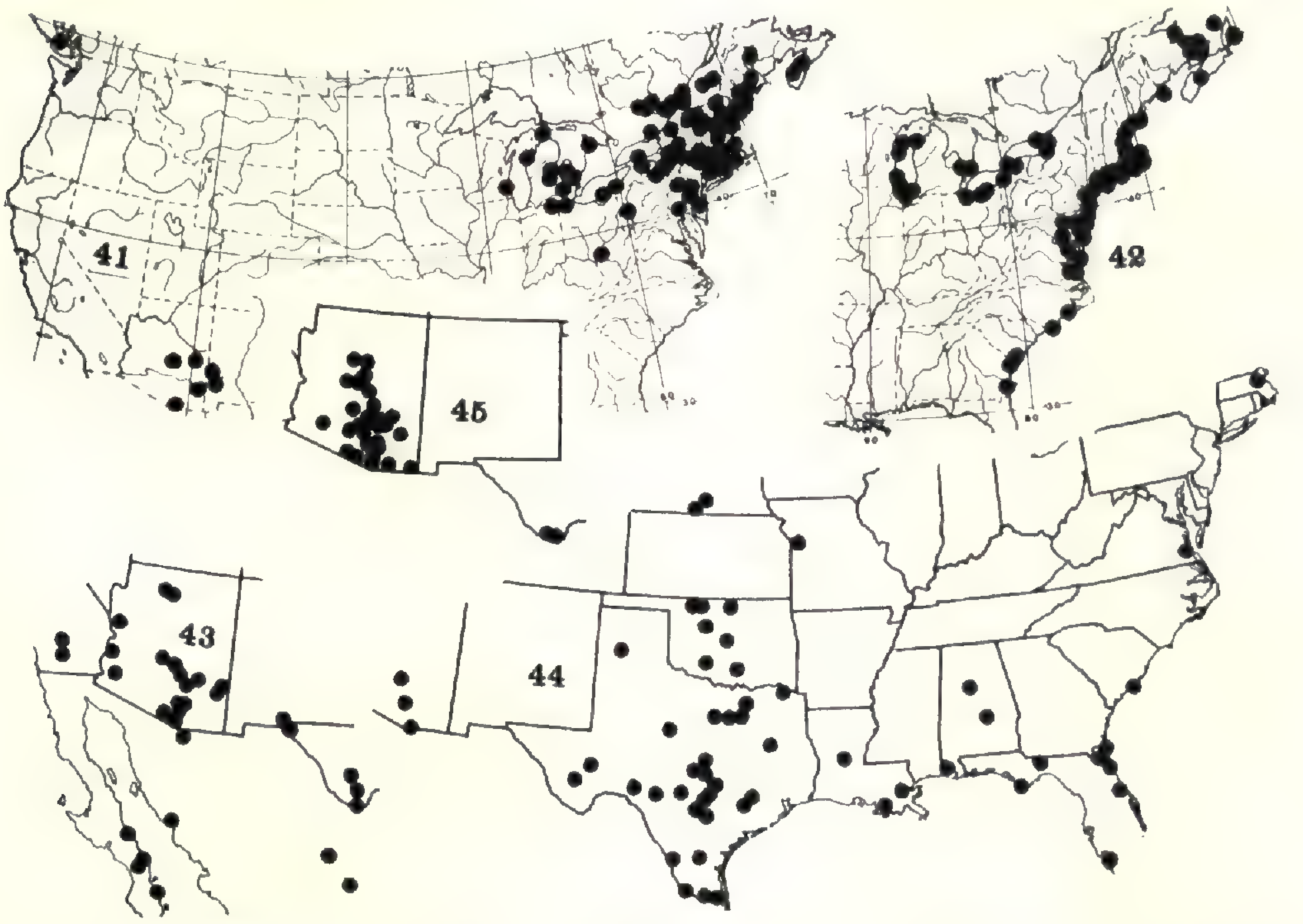
41b. E. VILLIFERA Scheele var. NUDA Engelm. ex Boiss. in DC. Prod. **15** (**2**)**:** 45. 1862. TYPE: Growing in the bed of a mountain torrent near New Braunfels, Comal County, Texas, Nov., 1850, *C. Wright* (M 200505!; photographs G!, W!; ISOTYPES G!, Ge!, NY!). Known only from the type collection.

This rather trifling variant is striking for being a glabrous member of an otherwise more or less pilose species.

42. EUPHORBIA SERRULA Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**)**:** 188. 1859. TYPE: Guadalupe Pass on mountains (between San Bernardino and Sierra de las Animas), Sonora?, Oct. 4, 1851, *C. Wright 1843* (M 144668!; photographs G!, W!; ISOTYPES G!, NY!).—*Chamaesyce serrula* (Engelm.) Wooton & Standley, Contr. U. S. Nat. Herb. **16:** 144. 1913.

Annual; stems few to several, mostly prostrate, 5–22 cm. long, 0.5–1 mm. thick, pilose, internodes up to 2.5 cm. long, average ca. 1 cm. long; leaf-blades 3–11 mm. long, glabrous to sparsely pilose above, more or less pilose beneath, broadly elliptic, oblong-lanceolate, oblong, or obovate-oblong, but most commonly oblong, often falcate, base markedly inequilateral, margin sharply serrate on the larger leaves to subentire on some of the smaller; petioles 0.5–1 mm. long; stipules distinct, glabrous to rarely ciliate, deltoid, attenuate, central lobe much exceeding the lateral and up to 1.7 mm. long; peduncles ca. 1 mm. long, glabrous to rarely sparsely pilose; cyathia at the upper nodes, solitary, but often crowded toward the branch-tips by the short

upper internodes; involucre 1–1.1 mm. in diam., shortly obconical-campanulate, glabrous to rarely sparsely pilose outside, sparsely short-hairy at the summit inside; lobes triangular, exceeding the glands, often 2–3-parted above; glands transversely elliptical to oblong, or rarely subcircular, slightly depressed in the middle, 0.2–0.6 mm. long; appendages white, glabrous, ca. as wide as to twice as wide as the glands, rounded, subentire to crenulate; fifth gland absent to nearly as long as lobes, linear;



Map 41, range of Euphorbia vermiculata in Canada & U. S.; 42, E. polygonifolia; 43, E. arizonica; 44, E. Chamaesyce in U. S.; 45, E. capitellata in U. S. (Maps 41 & 42 from Goode's Series of Base Maps, North America No. 102, by permission of the University of Chicago Press. Dotted lines are the thousand foot contour.)

sinus V-shaped, not depressed; bracteoles united and forming a radial appendage adnate to the involucre for ca. half its length, glabrous below, entire to 3-parted, sparsely pubescent above, about equaling the androphores; staminate flowers 7–13 per cyathium; androphores 1–1.1 mm. long, glabrous; gynophore long-exserted and usually reflexed, glabrous or rarely very sparsely pilose; ovary 3-lobed, glabrous; styles 0.3–0.4 mm. long, bifid halfway to nearly to the base, subclavate; capsule glabrous, 2.1–2.6 mm. long, broader than long, turgidly triangular in cross-section, broader below the equator, base truncate; seeds quadrangular, 1.5–2 mm. long, 1.1–1.5 mm. tangentially, 1.1–1.3 mm. radially, ovate to rotund-ovate radially, dorsal and lateral

angles subalate, ventral blunt, ventral facets plane to slightly concave, dorsal facets plane to slightly convex, surface essentially smooth, coat chalk-white to occasionally sordid.—Plate 658D.

Arizona, New Mexico, western Texas, Chihuahua, Coahuila, Durango, and Zacatecas (Map 7). Representative specimens seen: Arizona. Mohave Co.: 4 miles east of Peach Springs, *Kearney & Peebles 12767* (US). Pima Co.: Tucson, *Toumey 261* (US); common on mesas, Tucson, *Thornber 47* (M, NY, T, US). Cochise Co.: between Tombstone and Bisbee, *Harrison & Kearney 6085* (US); Mexican boundary line, south of Bisbee, *Mearns 902* (US). New Mexico. San Juan Co.: vicinity of Farmington, *Standley 7053* (US). Santa Fe Co.: valleys between the dry gravelly hills, Santa Fe, *Fendler 796* (G, M); near Tesuque, Aug. 20, 1904, *Wooton* (US). Socorro Co.: foothills east of Doyle Rentfrow's "desert claim", *Eggleston 19370* (US). Chaves Co.: 20 miles south of Rosswell, *F. S. & E. S. Earle 285* (US). Doña Ana Co.: beside the white sands, Aug. 24, 1899, *Wooton* (US); mesa near Las Cruces, Aug. 12, 1895, *Wooton* (NY). Eddy Co.: dry hillside near Carlsbad Cavern, *Standley 40397* (US). Co.? 1852, *C. Wright 1844* (G, M, NY). Texas. Hudspeth Co.: Eight Mile Well, *Cory 1942* (G). Culberson Co.: Van Horn, *Tharp 3557* (US); Walker Ranch, *Cory 1941* (G). Jeff Davis Co.: north edge of Davis Mountains, 5 miles east of Kent, *Rollins & Chambers 2761* (G). Terrell Co.: 25 miles northeast of Dryden, Holdeman Ranch, *Cory 3201* (G). "Collected in Expedition from western Texas to El Paso, New Mexico", May–Oct., 1849, *C. Wright 658* (G, NY). MEXICO: Chihuahua: volcanic mesa near Horcasitas, *Pringle 799* (G, M, US); pass between Las Animas and Chilicote Station, *I. M. Johnston 7995* (G); 8 miles northwest of Cruces, silty plain, *Johnston 7981* (G); 2 miles south of San Fernando, silty soil on plain, *Johnston 7940* (G); 3 miles north of Charco Piedra (21 miles northeast of Camargo), *Johnston 7928* (G). Coahuila: 12 miles north of Monclova, *Johnston 7196* (G); 2 miles northwest of Frontera (road from Monclova westward to beyond Cuatro Cienagas), *Johnston 7183* (G); 24 miles west of Saltillo, silty benches at base of hills, *Johnston 7673* (G); desert 41 miles west of Saltillo, *Johnston 7691* (G); Torreon, Oct. 13–20, 1898, *Ed. Palmer 501* (G, US). Durango: 19 miles north of Zaragoza, *Shreve 8820* (G); Mapimi, Oct. 21–23, 1898, *Ed. Palmer 532* (G, US). Zacatecas: Conception de Oro, Aug. 11–14, 1904, *Ed. Palmer 320* (G, US); Hacienda de Cedros, *Lloyd 209* (US); 5 miles south of Majoma, *Johnston 7393* (G).

43. Euphorbia indivisa (Engelm.) Tidestrom, Proc. Biol. Soc. Wash. **48:** 40. 1935.—*E. dioeca* HBK. var. ? *indivisa* Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**)**:** 187. 1859. Type:

"Stony hills near the Coppermines, Aug. 20, 1851", Grant County, New Mexico, *C. Wright 1845*, (G!; ISOTYPES M!, US!). Engelmann's specimen of this number was unnamed and also mounted in such a way that the relation of specimens and labels on the sheet is uncertain. Millsp., Field Mus. Pub. Bot. **2:** 387. 1914, designated as type the specimen at G.—*E. adenoptera* Bertol. var. *indivisa* (Engelm.) Boiss. in DC. Prod. **15 (2):** 49. 1862.—*Chamaesyce indivisa* (Engelm.) Millsp., Field Mus. Pub. Bot. **2:** 387. 1914.

Annual; stems few to several, prostrate, 6–25 cm. long, mostly 0.5–1 mm. thick, crisply pilose, the young tips densely so, internodes up to 2.5 mm. long, median ca. 1 cm., shortened to but 1 or 2 mm. at the branch tips; leaf-blades broadly ovate-deltoid-falcate and strongly asymmetrical (butterfly-wing-shaped) to oblong or even linear-oblong, 5–8 mm. long, mostly serrulate, mostly glabrous above, sparsely crisp-pilose beneath, often glabrate; petioles crisp-pilose, ca. 1 mm. long; stipules distinct, linear-subulate, 1–1.4 mm. long, usually entire, with short crisped hairs; cyathia subsessile, solitary at the nodes but clustered at the branch-tips by extreme shortening of the internodes; involucre cylindrical-campanulate, 0.9–1 mm. in diam., pubescent outside especially above, short-hairy within on the lobes; lobes subulate, proximal shorter than the glands, distal slightly exceeding the glands; glands transversely oval to oblong, usually folded, 0.25–0.6 mm. long, the proximal about twice as long as the distal; appendages white, rubescent, glabrous, irregularly wavy-margined, the distal fan-shaped, symmetrical, 0.2–0.3 mm. long, the proximal oblong to oblong-spatulate or obliquely elliptical, greatly prolonged parallel to the columella, 1.1–1.6 mm. long; fifth gland linear, half as long as the lobes; sinus U-shaped, depressed halfway to base of involucre; bracteoles about half as long as the androphores, of 1–3 linear segments opposite each gland, adnate below to the involucre, pubescent above; staminate flowers 5–15 per cyathium; androphores glabrous, 1.1–1.5 mm. long; gynophore crisply hairy above, reflexed into the sinus but scarcely exserted; ovary 3-lobed, densely strigose; styles glabrous, shortly united below, entire or sometimes bifid ⅓ to base, 0.7–1.3 mm. long; capsule strigose, 1.4–1.6 mm. long, subpyriform, strongly 3-lobed, base truncate; seeds quadrangular, 0.9–1.2 mm. long, 0.5–0.6 mm. tangentially, 0.4–0.5 mm. radially, narrowly ovate-acute radially, base truncate, facets with 3–5 rounded transverse ridges passing slightly through the angles, separated by sharp deep grooves, coat white, microreticulate, often but little obscuring the pale brown testa.—PLATE 663D.

Southern Arizona, southern New Mexico, western Texas, Sonora, Chihuahua, Durango, Coahuila, and San Luis Potosi

(Map 11). Representative specimens seen: Arizona. Pinal Co.: Oracle, *Eggleston 15951* (Ph). Pima Co.: Range Reserve near Tucson, Sept. 13, 1911, *Wooton* (US). Santa Cruz Co.: Patagonia Mountains, *Kearney & Peebles 10145* (US); Nogales, *Harrison & Kearney 6028* (G, US). Cochise Co.: Mescal, *Griffiths 1817* (NY); Bisbee, *C. E. Lloyd 459* (G); Rucker Valley, 1881, *Lemmon 454* (F, G). New Mexico. Sierra Co.: 2 miles south of Hillsboro, *Metcalfe 1292* (G, NY). Texas. Brewster Co.: Alpine, Sept. 1, 1909, *Mackensen* (M); 13 miles south of Alpine, *Cory 9264* (G); Limpia Canyon, Davis Mountains, *Hanson 744* (G). MEXICO: Sonora: gravelly arroyo, *Thurber* 963 (G); Rio Magdalena on road to Cananea and Remedios, *Wiggins 7073* (W). Chihuahua: hills and plains near Chihuahua, *Pringle 326* (G); 5 miles north of Mesteñas, *Johnston 7954* (G). Durango: 26 miles west of Mapimi, *Johnston 7780* (G). Coahuila: Soledad, Sept., 1880, *Ed. Palmer 1206* (G). San Luis Potosi: in arenosis, Morales, *Schaffner 855* (G).

This entity is very closely related to *E. dioeca* HBK. Since the other members of the group to which *E. indivisa* belongs are all extra-limital, the specific lines drawn by Millspaugh, Field Mus. Pub. Bot. **2:** 383–392. 1914, in his paper, "'Euphorbia adenoptera' in North America", are accepted, with some hesitation, until the group can be carefully studied.

The collection made in Texas in 1855 by *Dr. Antisell* (NY), reported by Engelmann in Emory, U. S. & Mex. Bound. Surv. **2 (1):** 187. 1859, as *E. dioeca* HBK., is here included under *E. indivisa*, as are also the plants described by Coulter, Contr. U. S. Nat. Herb. **2:** 389. 1894 as *E. adenoptera* Bertol.

44. Euphorbia thymifolia L., Sp. Pl. **1:** 454. 1753. Type: (?)—*Anisophyllum thymifolium* (L.) Haw., Syn. Pl. Succ., 160. 1812.—"**E.[uphorbia] maculata** L. (var. *thymifolia* L.)" Griseb., Fl. Brit. W. Ind. Isl., 53. 1859, basinym not stated but reference made to *E. maculata* δ. Pl. Carib. (not located).—*Chamaesyce thymifolia* (L.) Millsp., Field Mus. Pub. Bot. **2:** 412. 1916.

Additional synonyms listed by Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 438–439. 1917.

Annual (or short-lived perennial?); stems prostrate, mostly 0.5–1 mm. thick, strigose to strigose-tomentulose, sometimes glabrate at maturity, 15–30 cm. long, internodes on the main stems from a maximum of 2 cm. long to only ca. 1 mm. long on some of the lateral branchlets; petioles 0.5–1 mm. long; blades broadly elliptic to oblong (often narrowly so) and ovate-lanceolate, 3–10 mm. long, base inequilateral, apex blunt to acute, nearly glabrous above, sparsely tomentulose to subglabrous

beneath; stipules ca. 1 mm. long, linear-subulate, distinct or slightly united, entire or slightly parted, with erect hairs; cyathia subsessile, mostly in small cymes of 2-several on short lateral branchlets, involucres broadly obconical, soon distended and distorted by the base of the partially included capsule, upwardly strigose outside, subglabrous inside; lobes triangular, distal equaling the glands, proximal much shorter, upwardly strigose; glands red, subcircular to very broadly transversely oval, the distal the more nearly circular, 0.2–0.25 mm. in diam., slightly depressed in the center; appendages on distal glands symmetrical, margining the glands and 1½ times as wide, to rudimentary, on proximal glands up to twice as long as glands, asymmetrical, elongated toward the sinus, glabrous, white to pink, entire to crenulate; 5th gland absent; sinus broadly U-shaped, depressed nearly to base of involucre; bracteoles few, linear, sparsely pubescent; staminate flowers 3–5 per cyathium; androphores glabrous, 0.9–1.2 mm. long; gynophore very short (ca. 0.5 mm. long), strigose above; ovary densely hairy; styles bifid about halfway, glabrous, 0.4–0.5 mm. long, tips usually clavate; capsule upwardly strigose, sharply 3-angled, widest near the base, 1.1–1.5 mm. long; seeds sharply quadrangular, with low subregular transverse ridges often slightly including the angles, ovate to narrowly ovate radially, 0.8–0.9 mm. long, 0.45–0.55 mm. tangentially and radially.—PLATE 655A

Mexico, West Indies, South America, Old World tropics. This species is not known from the United States but is included here because of its close relationship with *Euphorbia supina*. The description given above is based on the following specimens: MEXICO: Tamaulipas: Tampico, June 3–6, 1910, *Ed. Palmer 572* (M). Sinaloa: Comedero, Jan. 27, 1940, *Gentry 5395* (W); Cofradia, Nov. 25, 1939, *Gentry 5062* (W).

The application of the name *E. thymifolia* here made is the traditional one. Whether the type in the Linnaean Herbarium is identical with the plants included here is uncertain. According to his notes, A. Gray considered the specimen of *E. thymifolia* in Linnaeus' herbarium identical with the entity called *E. supina* in this paper. That interpretation may be correct but Gray might easily have overlooked the small differences between these two entities. The customary application will be continued until definite evidence to the contrary is submitted by someone particularly acquainted with the plants concerned.

I am applying the name *E. thymifolia* in the sense in which it was used by Boissier in DC. Prod. **15** (**2**): 47. 1862. Thellung, in his discussion of his application of this name in Ascherson &

Graebner, Syn. Mitteleur. Fl. **7:** 475. 1917, states: "Linné's Herbarexemplar gehört nach Boissier (a. a. O. 1862), wie auch dasjenige des jüngeren Burmann, zu *E. thymifolia* in unserem Sinne." It is not at all certain that Boissier ever saw Linnaeus' specimen. Boissier merely stated: "157. E. thymifolia (Burmann fl. Ind. pag. 2, et herb.)." There is no definite evidence to indicate that the herbarium referred to is Linnaeus'.

45. EUPHORBIA SUPINA Raf., Amer. Monthly Mag. **2:** 119. 1817 (Dec.). TYPE: doubtless not extant. "Very common on the downs and seashores of Long-Island, north and south, also in New-Jersey, Sandy-Hook, &c."—*Xamesike supina* (Raf.) Raf., Aut. Bot., 87. 1840.—*Chamaesyce supina* (Raf.) Moldenke, An annotated and classified list of H. N. Moldenke collection numbers from No. 1 to No. 11,277 inclusive, 135. 1939.

E. littoralis Raf., Amer. Mo. Mag. **2:** 119. 1817 (Dec.), not *E. litoralis* HBK., Nov. Gen. et Sp. **2:** 54 (quarto), 43 (folio). 1817 (Apr.).[1] TYPE: doubtless not extant. " . . . it grows on the sandy and gravelly shores of the Hudson from New York to the falls".—*Xamesike littoralis* (Raf.) Raf., Aut. Bot., 97. 1840.

E. depressa Torrey, Cat. Pl. N. Y., 45. 1819, by reference to *E. maculata* L. *sensu* W. P. Barton, Comp. Fl. Phila. **2:** 185. 1818. TYPE: sandy fields and cultivated grounds, common near New York, probably *Torrey* (NY!; photographs G!, W!). Elliott, Sketch Bot. So.-Car. & Georgia **2:** 655. 1824; Sprengel, Syst. Veg. **3:** 794. 1826.—*Xamesike depressa* (Torr.) Raf., Aut. Bot., 97. 1840.

E. thymifolia Michaux, Fl. Bor.-Amer. **2:** 212. 1803. TYPE: Ohio and Mississippi Rivers and Illinois. *Michaux* (Herb. Mus. Paris; photograph G!).

E. thymifolia L. *sensu* Pursh, Fl. Amer. Sept., 606. 1814.

E. maculata L. *sensu* Torrey, Fl. State N. Y. **2:** 176. 1843, and virtually all subsequent American authors; Boissier in DC. Prod. **15** (**2**): 46. 1862; Small in Britton & Brown, Ill. Fl. No. U. S. & Can. **2:** 373. 1897; Robinson & Fernald, Gray's New Man. Bot. ed. 7, 547. 1908; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 465. 1917; Jepson, Man. Fl. Pl. Calif., 600. 1925. Not L.

E. meganaesos Featherman, Ann. Rep. Geol. Surv. Louisiana **2:** 71. 1871. TYPE: Grand Isle, Louisiana, *Featherman?* (Louisiana State University?; ISOTYPE G!). A narrow-leaved, apparently erect maritime ecotype representing an almost indefinable tendency.

Chamaesyce Tracyi Small, Fl. Se. U. S., 713, 1333. 1903. TYPE: Biloxi, Harrison County, Mississippi, July 15, 1894 (NY!; photographs G! W!). The same ecotype as *E. meganaesos*.

[1] Date according to Barnhart, Bull. Torr. Bot. Club **29:** 597. 1902.

Chamaesyce Mathewsii Small, Man. Se. Fl. 797, 1505. 1933. TYPE: sand dunes opposite Miami, Dade County, Florida, Nov. 26–Dec. 20, 1913, *J. K. & G. K. Small 4556* (NY!; photographs G!, W!). A robust maritime ecotype intergrading too generally for recognition.

Annual; stems prostrate to erect, sparsely villous or the young stems subtomentose, sometimes glabrate but stem-tips always vestite, 10–45 cm. long; leaf-blades 4–17 mm. long, elliptic-ovate, oblong-ovate to linear-oblong, the larger with inequilateral base, sparsely villous, often glabrate especially above, serrulate to subentire; petioles 1–1.5 mm. long, 2–3-parted, villous; cyathia solitary at the nodes but mostly borne on short congested lateral branches; involucres obconical, ca. 0.8 mm. in diam., villous; glands 0.15–0.25 mm. long, transversely elongate; fifth gland filiform, ½ as long to ca. equaling the lobes; sinus U-shaped, depressed, ¼ to ⅓ to base of involucre, long-hairy; appendages narrow, white, glabrous, irregularly crenulate; staminate flowers 4–5 (sometimes 2–3) per cyathium; androphores glabrous, 0.9–1.2 mm. long; gynophore crisply hairy, barely exserted and mostly reflexed; ovary densely strigose; styles ca. 0.4 mm. (rarely to 0.6 mm.) long, ¼–⅓ bifid, clavate, capsule sharply 3-angled. strigose, often partially glabrate, wider below the equator, ca, 1.4 mm. long; seeds quadrangular, ca. 1 mm. long, ovate radially, facets with subregular low transverse ridges often slightly including the angles, coat whitish-brown.—PLATE 662D.

Quebec and Ontario; general in eastern United States, west to North Dakota and Texas; introduced in Oregon, California, and Arizona; introduced in Europe (MAP 34). Representative specimens seen: QUEBEC. Wright Co.: Chelsea, *Macoun 87833* (G). Pontiac Co.: Chichester, *Marie-Victorin, Rolland-Germain & Meilleur 44016* (G). ONTARIO. Ottawa, Broad St. Station, *Macoun 87834* (G); Amherstburgh, *Macoun 88081* (G); Chatham, *Macoun 88088* (G); Niagara Falls, *Macoun 88083* (G); Owen Sound, *Macoun 88086* (G); Port Colborne, *Macoun 88082* (G); Southampton, *Macoun 88087* (G); Windsor, *Macoun 88085* (G); Wooler, *Macoun 88084* (G). MAINE. Androscoggin Co.: Auburn, *E. D. Merrill 1649* (NE). Aroostook Co.: Island Falls, *Fernald 2739* (NE). Cumberland Co.: Portland, *Fernald, Long & Norton 13999* (NE, Ph); Brunswick, Aug. 23, 1910, *Furbish* (NE). Hancock Co.: Schooner Head Road, Bar Harbor, Mount Desert Island, Sept. 18, 1896, *Rand* (NE). Kennebec Co.: Winslow, *Fernald 2736* (NE); Clinton, July 20, 1907, *Bean* (NE). Franklin Co.: Farmington, Sept. 2, 1904, *Knowlton* (NE). Penobscot Co.: Lagrange, *Fernald & Long 13997* (NE, Ph). Piscataquis Co.: Abbot Village, *Fernald & Long 13998* (NE, Ph). Sagadahoc Co.: Bath, July 12, 1912, *Furbish* (NE). Washington Co.: Valley of the St. Croix River, Sept. 1, 1908, *Fernald* (NE). York Co.: Old

Orchard, *Chamberlain 228* (NE); York, Mt. Agamenticus, Aug. 17, 1905, *Chamberlain* (NE). New Hampshire. Cheshire Co.: East Swanzey, *Robinson 539* (G, NE). Coös Co.: Whitefield, *Pease 11616* (NE); Berlin, *Moore 4329* (G). Grafton Co.: Plymouth, Aug. 24, 1916, *Knowlton* (Ph). Hillsboro Co.: Pelham, Sept. 13, 1902, *Knowlton* (G). Merrimack Co.: Aug. 24, 1925, *Batchelder* (NE). Rockingham Co.: Hampton Falls, Sept. 8, 1916, *Batchelder* (NE). Vermont. Chittenden Co.: Burlington, July 6, 1919, *Knowlton* (Ph). Windham Co.: Bellows Falls, July 18, 1896, *Deane* (NE). Windsor Co.: Windsor, Aug. 22, 1880, *Leland* (NE). Massachusetts. Barnstable Co.: Harwich, *Fernald & Long 18687* (NE, Ph); Brewster, *Collins 1176* (NE); Yarmouth, *Collins 981* (NE). Berkshire Co.: Stockbridge, July 20, 1919, *Hoffmann* (NE). Bristol Co.: New Bedford, Aug. 5, 1904, *Hervey* (NE). Dukes Co.: Elizabeth Islands, *Fogg 2869* (NE). Essex Co.: Salem, *Forbes 2315* (NE). Hampshire Co.: West Chesterfield, *Robinson 489* (G). Hampden Co.: Springfield, July 15, 1915, *Andrews* (NE). Middlesex Co.: Arlington, *Pease 4704* (NE); Winchester, *L. B. Smith 2496* (NE). Norfolk Co.: Norfolk, *Ware 4138* (NE). Plymouth Co.: Hull, *Rothrock* (NE). Suffolk Co.: Savin Hill Beach, Boston, Aug. 28, 1853, *W. Boott* (G); Revere, Oak Island, July 9, 1882, *Young* (NE). Rhode Island. Newport Co.: Clay Head, Block Island, *Fernald, Long & Torrey 9822* (G, NE, Ph). Providence Co.: Providence, Aug. 20, 1907, *Hope* (G). Washington Co.: Hopkinton, Aug. 30, 1919, *Ware, Woodward & Harger* (NE). Connecticut. Fairfield Co.: Stratford, Fresh Pond, Aug. 15, 1897, *Eames* (NE). Middlesex Co.: Killingworth, Sept. 3, 1874, *Hall* (NE). New Haven Co.: Naugatuck, *Harger 5519* (Ph); South End, New Haven, Long Island Sound, *Castle 104* (NE). New London Co.: Franklin, Oct. 1, 1910, *Woodward* (NE). Tolland Co.: Bolton, *Weatherby 5104* (NE). Windham Co.: Central Village, *Sheldon 514* (NE). New York. Albany Co.: Albany, Sept. 2, 1908, *Burnham* (G). Bronx Co.: Thorn's Dock, Oct. 2, 1891, *Bicknell* (Ph). Richmond Co.: Port Richmond, Staten Island, *Dowell 6735* (M). St. Lawrence Co.: Canton, *Phelps 636* (G). Tompkins Co.: Ithaca, *Bechtel 8409* (G). Washington Co.: Vaughns, north of Hudson Falls, Aug. 28, 1891, *Burnham* (G). New Jersey. Atlantic Co.: within 1 mile south along Great Egg Harbor River, Catawba, *Long 51184* (G). Burlington Co.: Delanco, *Hermann 3631* (PhB). Camden Co.: Lawnside, *Stone 1077A* (PhB). Cape May Co.: Cape May City, Aug. 2, 1917, *Stone* (PhB). Cumberland Co.: Cumberland, *Long 38946* (PhB). Essex Co.: Watchung Mt., *Pennell 7459* (Ph). Middlesex Co.: Stelton, *Halsted's* American Weeds 88 (G, Mo). Ocean Co.: Lakewood, *Hunnewell 8081* (G). Somerset Co.: Watchung, *Moldenke 1303* (Ph). Pennsylvania. Berks Co.: Fleetwood,

Leibelsperger 52 (PhB). Bucks Co.: Grenoble, *Long 4601* (PhB). Chester Co.: Honey Brook, *Benner 5418* (PhB). Columbia Co.: west branch Fishing Creek, 25 miles above Central, *Fosberg 15968* (G). Lebanon Co.: in South Mountain, Penryn, *Heller 669* (G). Lehigh Co.: near Allentown, *Pretz 4842* (PhB). Montgomery Co.: Souderton, *Long 26754* (PhB). Northampton Co.: Northampton, Aug. 17, 1923, *Churchill* (G). Philadelphia Co.: Holmesburg, *Benner 7335* (G, PhB). Delaware. New Castle Co.: Newark, Oct. 18, 1923, *Otis* (PhB). Sussex Co.: Rehoboth, Aug. 15, 1895, *Commons* (Ph). District of Columbia: Brookland, Oct. 13, 1915, *Holm* (G); Washington, Aug. 18, 1888, *Holm* (G). Virginia. Amherst Co.: Monroe, Aug. 16, 1899, *Pieters* (US). Arlington Co.: near Ballston, Sept. 20, 1935, *Blake* (W). Bedford Co.: Sept. 25, 1871, *A. H. Curtiss* (G). West Virginia. Cabell Co.: Roland Park, *Gilbert 493* (Mo, Ph). Grant Co.: Bayard, *Moore 1950* (G). Greenbrier Co.: White Sulphur Springs, *Hunnewell 2827* (G). Mineral Co.: Keyser, *Moore 1948* (G). Tucker Co.: along Shavers Fork near Parsons, *Greenman 408* (G). North Carolina. Buncombe Co.: Biltmore, *Biltmore Herbarium 407b* (G). Cartaret Co.: shore of North River, *Randolph 827* (G). Pender Co.: Hampstead, *Randolph 989* (G). South Carolina. Berkeley Co.: Santee Canal, *Ravenel* (G). Charleston Co.: Charleston, *Fernald & Long 9748* (G). Lancaster Co.: Elgin, *House 2583* (M). Marion Co.: Marion, *Wiegand & Manning 1814* (G). Georgia. Whitfield Co.: Dalton, Chickamauga, *Harper 380* (G). Florida. Bradford Co.: Hampton, *Wiegand & Manning 1816* (G). Dade Co.: sand-dunes opposite Miami, *J. K. & G. K. Small 4580* (NY). Duval Co.: *Fredholm 5138* (G). Escambia Co.: Pensacola, 1886, "*A. W. Curtiss*" (G). Gulf Co.: Apalachicola, *Chapman* (G). Hillsborough Co.: *Fredholm 6469* (G). Lake Co.: near Eustis, *Nash 1058* (G). Lee Co.: Alva, *A. S. Hitchcock 328* (G). Palm Beach Co.: Palm Beach, *Hunnewell 7365* (G). Pinellas Co.: St. Petersburg, *Deam 2797* (G). Michigan. Allegan Co.: *Dohmen 61* (F). St. Joseph Co.: Sturgis, Aug., 1898, *Daniels* (Mo). Washtenaw Co.: Ann Arbor, *Hermann 9115* (G). Ohio. Portage Co.: Garrettsville, *Webb 469* (G). Scioto Co.: Moore's Lane, Friendship, *Demaree 10788* (G). Indiana. Cass Co.: 2 miles west of Hoover, *Deam 34640* (Ph); 2 miles west of Royal Center, *Deam 29566* (Deam). Clay Co.: six miles east of Brazil, *Deam 37789* (Deam). Elkhart Co.: 4 miles north of Elkhart on Simonton Lake, *Deam 52954* (Deam). Jasper Co.: 5 miles east of Wheatfield, *Deam 26533* (Deam). Lake Co.: north side of Cedar Lake, *Deam 21389* (Deam). Marion Co.: Pine, *Umbach 2315* (G). Morgan Co.: north of Martinsville, along Traction Line, *Deam 13935* (Deam). Noble Co.: north side of Waldron Lake on Orange Township, Aug. 9, 1905, *Deam* (Deam). Parke Co.: ½ mile

west of Bloomingdale, *Deam 41921* (Deam). Pike Co.: 1 mile west of Cato, *Deam 52655* (Deam). Porter Co.: northwest of Porter, *Lansing 1636* (Ph). Pulaski Co.: 2½ miles southeast of Denham, *Deam 29862* (Deam). St. Joseph Co.: South Bend, *Nieuwland 11736* (M). Starke Co.: 3 miles west of North Judson, *Deam 32212* (Deam). Sullivan Co.: 5 miles southeast of Sullivan, *Deam 25691* (Deam). Tippecanoe Co.: 2 miles south of Battle Ground, *Deam 49615* (Deam). Warren Co.: 7 miles west of Williamsport, *Deam 37890* (Ph). Washington Co.: 6 miles west of Pekin, *Deam 18980* (Deam). White Co.: bank of Tippecanoe River, 2 miles northeast of Monticello, *Deam 32671* (Deam, G). Kentucky. Harlan Co.: near Poor Fork Post Office, *Kearney 156* (G). Kenton Co.: Banklich Creek, Sept. 25, 1838 (Ph). Tennessee. Davidson Co.: campus of Peabody College, Nashville, *Svenson 137* (G). Alabama. Jefferson Co.: west side of Library, Birmingham, *H. E. Wheeler 140* (G). Lee Co.: Auburn, *Earle 35* (G). Tuscaloosa Co.: Tuscaloosa, Sept., 1898, *Mohr* (US). Mississippi. Harrison Co.: Biloxi, *Pollard 1155* (G). Panola Co.: Sept. 17, 1896, *Eggert* (M). Wisconsin. Iowa Co.: Wyoming, *Fassett 12574* (M). Milwaukee Co.: Milwaukee, *Ogden 7* (F). Pierce Co.: Prescott, *Fassett 10287* (Deam); Bay City, *Fassett & Wilson 10281* (G). Illinois. Champaign Co.: Champaign, *Gleason 1932* (G). Cook Co.: Stony Island, *H. H. Smith 5979* (G, M, Ph). Hancock Co.: Augusta, Aug., 1859, *Mead* (G); Augusta, Sept. 21, 1860, *Mead* (G). Henry Co.: Atkinson, Aug., 1921, *Ledman* (M). Kankakee Co.: Altorf Island in Kankakee River, *Lansing & Sherff 5* (G). La Salle Co.: Ottawa, *Juett* (G). Peoria Co.: Peoria, Aug., 1903, *McDonald* (G). Richland Co.: Olney, *Ridgway 3133* (Ph). Stark Co.: Wady Petra, *V. H. Chase 696* (Ph). Vermilion Co.: Muncie, *Pease 14104* (G). Winnebago Co.: South Beloit, *Wadmond 2943* (G). Minnesota. Chisago Co.: Taylors Falls, Sept., 1893, *Ballard* (Mi). Goodhue Co.: Burntside, *Anderson 777* (Mi). Hennepin Co.: Fort Snelling Reservation, *Rosendahl 2332* (Mi). Houston Co.: Jefferson, *W. A. Wheeler 430* (Mi). Hubbard Co.: Itasca Park, *Moyle 762* (Mi). Lincoln Co.: Lake Benton, *Sheldon 1560* (Mi). Pipestone Co.: Pipestone, Aug. 11, 1925, *Peterson* (Mi). Scott Co.: Cleary's Lake, *Ballard 526* (Mi). Wabasha Co.: Brook Lodge, Aug. 15, 1904, *Roberts* (Mi). Washington Co.: Afton, Sept., 1919, *Butters* (Mi). Winona Co.: Latsch Island, Winona, *Fassett 3413* (G). Iowa. Dallas Co.: Aug. 2, 1867, *Allen* (G). Fayette Co.: Fayette, July, 1894, *Fink* (G). Story Co.: Ames, Sept., *Pammel 34* (G). Missouri. Barry Co.: White River at Cutner Ford 2 miles northwest of Golden, *Steyermark 19543* (M, Mo). Boone Co.: Columbia, *Drouet 1012* (Mo). Cole Co.: Jefferson City, Aug., 1871, *Krause* (M). Cooper Co.: *Bush 15125* (Mo). Dunklin Co.: Campbell, Oct. 23, 1893, *Bush* (M). Franklin Co.:

Gray Summit, *Kellogg 1845* (M). Henry Co.: July 3, 1892, *Link* (Mo). Jackson Co.: Courtney, *Bush 7068* (G). Jefferson Co.: 4 miles southwest of Pevely, *Steyermark 506* (M). Laclede Co.: Fork of Gasconade River 1 mile west of Dry Knob, *Steyermark 13925* (Mo). Marion Co.: Hannibal, *Davis 1419* (M). Saint Clair Co.: 1 mile north of Collins, Oct. 4, 1930, *Drouet* (Mo). St. Louis Co.: Jefferson Barracks, *Bartram 3053* (Ph). Saline Co.: below Glasgow Bridge on Highway 20, *Drouet 1607* (Mo). Arkansas. Crawford Co.: Van Buren, *Demaree 15278* (W). Drew Co.: Monticello, *Demaree 13521* (W). Garland Co.: 8 miles east of Hot Springs, *Scully 284* (G). Grant Co.: Saline River, Poyen, *Demaree 16331* (W). Hempstead Co.: Tokio, *Demaree 9931* (G, M). Hot Springs Co.: Malvern, *Demaree 16298* (Mo, W). Jefferson Co.: Pine Bluff, *Demaree 15407* (W). Montgomery Co.: Caddo Gap, Small Creek, *Demaree 9582* (M, Ph). Polk Co.: Mena, *Demaree 16057* (W). Pope Co.: Russellville, *Demaree 15334* (W). Prairie Co.: White River Ridges, de Valls Bluff, *Demaree 15736* (W). Pulaski Co.: Little Rock, *Demaree 8202* (M). Scott Co.: Mansfield, *Demaree 18180* (W). Louisiana. Boissier Co.: Alden Bridge, 1898, *Trelease* (M). Caddo Co.: Shreveport, Sept. 20, 1847, *Gregg* (Ph). Plaquemines Co.: Port Eads, *Tracy & Lloyd 209* (G, Ph). Terrebonne Co.: Houma, on Little Temple, *Wurzlow* (F). North Dakota. Cass Co.: Fargo, Oct. 16, 1911, *Waldron* (G, Ph). Nebraska. Kearney Co.: Minden, Aug. 27, 1929, *Hapeman* (Ph). Nemaha Co.: Peru, *Michels 419* (O). Otoe Co.: Nebraska City, Aug., 1898, *Thornber* (M). Webster Co.: Blue Hill, *Bates 5025* (G). Kansas. McPherson Co.: Lindsborg, June, 1884, *Bodin* (F). Riley Co.: *Norton 471* (G). Oklahoma. Alfalfa Co.: near Goltry, *G. W. Stevens 1334.1* (G). Creek Co.: Sapulpa, *Bush 536* (M). Harmon Co.: Hollis, *G. W. Stevens 1054* (G). Le Flore Co.: Stapp, *Demaree 16041* (W). Mayes Co.: near Mazie, *G. W. Stevens 2584* (G). Oklahoma Co.: near Oklahoma City, *White 1145* (G). Osage Co.: near Copan on Coon Creek, *G. W. Stevens 2170* (G). Ottawa Co.: near Miami, *G. W. Stevens 2307* (G). Pawnee Co.: Pawnee, Aug. 31, 1933, *Coffman* (Mo). Woods Co.: near Alva, *G. W. Stevens 1603* (G). Texas. Anderson Co.: Palestine, Oct. 21, 1884, *Joor* (M). Aransas Co.: 5 miles east of Rockport, *Cory 20383* (G). Burnet Co.: Bluffton, 1879, *Ed. Palmer 1198* (G). Chambers Co.: 5¾ miles south of Anahuac, *Cory 22451* (G). Fayette Co.: ¾ miles south of Monument Hill, *Cory 10046* (G). Gillespie Co.: Bear Mt., *Cory 24574* (G). Grayson Co.: Denison, Sept. 30, 1933, *Rotchslein* (M). Harris Co.: Houston, *Hall 569* (G); Houston, 1842, *Lindheimer* (G). Kerr Co.: Kerrville, *Heller 1921* (Ph). Matagorda Co.: 2½ miles west of Gulf, *Cory 11547* (G). Nueces Co.: Corpus Christi, *Heller 1804* (G, Ph). Parker Co.: Weatherford, *Tracy 7858* (Mo).

Uvalde Co.: Uvalde, 90 miles northwest of San Antonio, 1879, *Ed. Palmer 1202* (G). Valverde Co.: Devils River, *Orcutt 6074* (M). Walker Co.: 14 miles southwest of Huntsville, *Cory 10224* (G). Wharton Co.: Pierce, *Tracy 7436* (G). Williamson Co.: Georgetown, 1879, *Ed. Palmer 1202* (Ph). Wilson Co.: 5 miles east of Floresville, *Cory 11812* (G). ARIZONA. Greenlee Co.: 6 miles north of Metcalf, *Maguire, Richards & Moeller 11808* (G, I). Pima Co.: Tucson, July 19, 1934, *Thornber* (T). OREGON. Jackson Co.: Ashland, *T. Howell 720* (G). Josephine Co.: Grants Pass, *J. Howell & T. J. Howell 787* (G). CALIFORNIA. Siskiyou Co.: Yreka, *L. C. Wheeler 3652* (G, W). Shasta Co.: below Redding, *Heller 14802* (NY). Calaveras Co.: South Fork Calaveras River, Kentucky House, Sierra Nevada, *Jepson 10042* (J). Butte Co.: Chico, *W. H. Wheeler 296* (W). Alameda Co.: West Berkeley, July, 1891, *Michener & Bioletti* (J). Ventura Co.: Ventura, *Abrams 4132* (G, Ph). Los Angeles Co.: Pasadena, *Grant 427* (J). Riverside Co.: Santa Ana River at Chino Creek, *L. C. Wheeler 1330* (W). San Bernardino Co.: Colton, *M. E. Jones 3201* (I). San Diego Co.: San Diego, *Spencer 970* (G).

E. thymifolia β *disticha* Nutt., Trans. Amer. Philos. Soc., n. s. **5:** 171. 1837. TYPE: "Hab. Banks of the Mississippi and Arkansas" (Ph? or British Mus.?), not located. This variety may well belong here but no authentic material has been located.

E. maculata L. β *detonsa* Engelm. ex. Boiss. in DC. Prod. **15** (**2**)**:** 47. 1862. TYPE: "In civitatibus australioribus Amer. bor. (Engelm.)" (M? or Ge?), not located. This variety probably belongs here but no authentic material found.

There is one glabrous collection of *E. supina:* Cameron, Cameron Co., Louisiana, July 4, 1903, *Tracy 8477a* (G, M).

It may be that authentic material of *E. supina* Raf. exists at Geneva. Boissier in DC. Prod. **15** (**2**)**:** 47. 1862, appears to have taken the name from exsiccatae rather than from the article in the American Monthly Magazine, for no page is cited and Boissier does not mention the other two *Euphorbiae* that appeared in the same article. Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 471. 1917, cites "*E. supina* Rafin.!" which makes it appear that he has examined the Rafinesquean specimen at Geneva.

For discussion of the history of the misapplication of the name *E. maculata* L. see Contr. Gray Herb. **127:** 74–76. 1939.

The identity of the Linnaean specimen of *E. thymifolia* L. has not been investigated. In view of the very close relationship between the entity to which that name has been applied and *E.*

supina it is entirely possible that *E. thymifolia* might be applicable to the entity here called *E. supina.*

The identity of *E. supina* seems beyond question. It is the only prostrate pilose *Euphorbia* with opposite leaves and vestite capsules occurring in the area mentioned by Rafinesque.

46. Euphorbia humistrata Engelm. ex Gray, Man. Bot. No. U. S., ed. 2, 386. 1856. Type: banks of the Mississippi, St. Louis, Missouri, July, 1833, *Geo. Engelmann 1139* (M 149873!; photographs G! W!). Boiss. in DC. Prod. **15** (**2**): 44. 1862.—*Anisophyllum humistratum* (Engelm.) Klotzsch & Garke, Abh. Akad. Berlin, Phys. **1859**: 26. 1860.—*Chamaesyce humistrata* (Engelm.) Small, Fl. Se. U. S., 713, 1333. 1903.

Annual; stems prostrate to ascending, crisply and sparsely villous, sometimes glabrate below, to 35 cm. long, internodes mostly 1–3 cm. long; leaf-blades oval to oblong-ovate on the main stems, often narrower and much reduced on the branchlets, 4–14 mm. long, mostly glabrous above, sparsely crisply villous but glabrate below, margin entire to remotely serrulate, base strongly inequilateral; petioles 1–1.5 mm. long; stipules distinct to united, triangular, attenuate, 1–1.5 mm. long, mostly with linear divisions, ciliate; peduncles ca. 1 mm. long, crisply hairy to glabrate; cyathia solitary at the nodes or, more commonly, in dense clusters on short lateral branches; involucre obconical, 0.6–0.8 mm. in diam., villous outside, essentially glabrous inside; lobes triangular, attenuate, slightly exceeding the glands; glands mostly transversely oblong to elliptical, sometimes subcircular, 0.15–0.3 mm. long; appendages narrow, white to pink, crenulate to entire; fifth gland linear, ca. ½ as long as the lobes; sinus U-shaped, wide, depressed fully halfway to base of involucre; bracteoles minute, linear; staminate flowers 3–5 per cyathium; androphores glabrous, ca. 1.3 mm. long; gynophore slightly vestite above, barely exserted, mostly reflexed; ovary 3-lobed, densely strigose; styles glabrous, ca. 0.7 mm. long, ca. ½ bifid, slender; capsule strigose, sometimes partially glabrate, sharply 3-angled; 1.3–1.4 mm. long, wider below the equator; seeds quadrangular, 0.9–1 mm. long, 0.7–0.8 mm. tangentially, 0.6–0.7 mm. radially, radially broadly ovate, facets nearly smooth, coat brown, granular.—Plate 662C.

Ohio west to Illinois and Kansas, south to Alabama, west to extreme northeastern Texas; adventive in Virginia (Map 40). Representative specimens seen: Virginia. Henrico Co.: railroad ballast, Richmond, Fredericksburg and Potomac Railroad, Richmond, *Fernald & Long 12708* (W); waste places and railroad ballast, South Richmond, *Fernald & Long 12709* (W). Ohio. Champaign Co.: Sept. 10, 1892, *Werner* (NY, Ph).

Hamilton Co.: near Cincinnati, *Lloyd 2485* (Ph). INDIANA: Crawford Co.: bank of Ohio River in Leavenworth, *Deam 48035* (Deam). Dearborn Co.: bank of Ohio River in Aurora, *Deam 41122* (Deam). Dubois Co.: Hunnely bottom, 2 miles east of Huntingburg, *Deam 42635* (Deam). Gibson Co.: swamp 3 miles south of Mt. Carmel, Ill., *Deam 24230* (Deam). Greene Co.: swamp 1 mile north of Newberry, *Deam 24101* (Deam). Harrison Co.: bank of Ohio River 4 miles southeast of Laconia, *Deam 41514* (Deam). Jackson Co.: 6 miles north of Crothersville, *Deam 38092* (Deam). Jefferson Co.: bank of Ohio River 4 miles east of Madison, *Deam 40038* (Deam). Knox Co.: bank of White River near its mouth, *Deam 26597* (Deam, NY). Ohio Co.: bank of the Ohio River at the ferry in Rising Sun, *Deam 50800* (Deam). Perry Co.: bank of Ohio River 6 miles east of Cannelton, *Deam 26745* (Deam). Posey Co.: bank of Wabash River 2 miles below New Harmony, *Deam 24270* (Deam, NY). Sullivan Co.: bank of ditch 6 miles northwest of Carlisle, *Deam 51438* (Deam). Switzerland Co.: bank of Ohio River in Vevay, *Deam 50817* (Deam). Vermillion Co.: bank of creek 1½ miles northwest of Eugene, *Deam 51351* (Deam). Vigo Co.: Greenfield Bayou 9 miles west of Pimento, *Deam 23989* (Deam). Warrick Co.: bank of Big Pigeon Creek 6 miles west of Boonville, *Deam 24344* (Deam). ILLINOIS. Menard Co.: Athens, 1863, *Hall* (M). Peoria Co.: Illinois River bottomlands near Peoria, Aug., 1903, *McDonald* (NY). Rock Island Co.: Rock Island, Aug. 10, 1866, *Engelmann* (M). St. Clair Co.: Sept. 10, 1886, *Eggert* (G, M, NY). KENTUCKY: Lyon Co.: Kuttawa, *Eggleston 5246* (M, NY). Kenton Co.: Banklick Creek, Aug. 30, 1834, *T. G. Lea Herb.* (Ph). TENNESSEE. Davidson Co.: along Cumberland River, near Nashville, *Gattinger 2485* (G, M, Ph). ALABAMA: Autauga Co.: bank of Alabama River at House Bluff, *Harper 40* (G, NY, Ph). MISSISSIPPI. Warren Co.: Vicksburg, *Demaree 14111* (W). MISSOURI. Barry Co.: White River, Sept. 22, 1896, *K. K. Mackenzie* (NY). Bates Co.: Osage River at bridge south of Amoret, *Steyermark 20281* (M). Clark Co.: 2 miles west of Gregory Landing, Sept. 6, 1934, *Drouet* (G, M, Mo). Cole Co.: Osage River lock, *Rickett 1134* (Mo). Cooper Co.: 10 miles southwest of Boonville & south of Lanvine, *Steyermark 15910* (M, Mo). Jackson Co.: Sheffield, *Bush 12324* (M, NY). Jefferson Co.: Kimmswick, Sept., 1868, *Engelmann* (M). Laclede Co.: Osage Fork of Gasconade River, *Steyermark 13931* (M, Mo). New Madrid Co.: near La Forge, *Steyermark 8843* (M). Perry Co.: Mississippi River, 1½ miles north of Wittenburg, *Steyermark 14085* (M, Mo). Pulaski Co.: along Gasconade River between Laquey and Richland, *Steyermark 19867* (M). St. Clair Co.: 3½ miles north of Iconium at Wagon Ford, *Steyermark 24317* (NY). St. Louis Co.: junction of Missouri and Mississippi

Rivers on island, *Steyermark 19716* (M). ARKANSAS. Chicot Co.: Eudora, near La Fourche Lake, *Demaree 18575* (W). Drew Co.: Monticello, *Demaree 18410* (W). Lincoln Co.: Bayou Bartholomew, York Town, *Demaree 13729* (M, NY). Prairie Co.: De Valls Bluff on White River bottoms, *Demaree 15521* (NY). Pulaski Co.: along Arkansas River at Little Rock, *Demaree 8328* (G, NY). LOUISIANA. Terrebonne Co.: Houma, Aug. 21, 1912, *Wurzlow* (NY). KANSAS. Miami Co.: Paola, Sept. 19, 1885, *Oyster* (NY). OKLAHOMA. Nowata Co.: Lenapah, *G. W. Stevens 2182* (G, NY). Ottawa Co.: bar by Neosleo River, near Miami, *G. W. Stevens 2309* (G, M, NY). Rogers Co.: Verdigris, *Bush 537* (G, M, NY). TEXAS. Bowie Co.: Texarkana, May 9, 1891, *Plank* (NY).

This species seems to grow usually on river flats, judging by the meager habitat-data given by collectors on their labels. Some specimens are difficult to place definitely in *E. humistrata* for it approaches *E. supina* very closely. Reports of *E. humistrata* from states other than those from which specimens are cited above are probably based on misidentifications of *E. supina.*

47. EUPHORBIA STICTOSPORA Engelm. in Emory, U. S. & Mex. Bound. Surv. **2** (**1**)**:** 187. 1859. TYPE: steep bank of the Pawnee River ("fork"), in loose soil, Kansas, Sept. 8, 1847, *A. Fendler 798* (M 200482!; photographs G!, W!). (Type designated by Millspaugh, Bot. Gaz. **26:** 266. 1898.) Boiss. in DC. Prod. **15** (**2**)**:** 41. 1862.—*Chamaesyce stictospora* (Engelm.) Small, Fl. Se. U. S., 714, 1334. 1903.

Anisophyllum senile Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 28. 1860. TYPE: Los Baños, Mexico, *C. Ehrenberg* (B!; photographs G!, W!; ISOTYPE M!).

Annual; stems prostrate to ascending, crisply villous, 5–25 cm. long, internodes mostly 1–2 cm. long on the main stems; leaf-blades suborbicular, ovate, oblong-acute to oblong-linear and obovate, 3–10 mm. long, sparsely crisply hairy and glabrate above, similarly but more densely and permanently vestite beneath, margin sharply serrate, base oblique; petioles ca. 1 mm. long; stipules triangular, often attenuate, distinct or united, sometimes divided, ca. 1 mm. long, sparsely hairy; cyathia solitary at the nodes but mostly on congested short densely leafy lateral branches; peduncles mostly 1–2 mm. long, pubescent; involucre obconical, tapering to the peduncle, 0.7–1 mm. in diam., pubescent outside, essentially glabrous inside; lobes triangular, ciliate, about equaling the glands; glands transversely oblong to elliptical or even subcircular, 0.15–0.3 mm. long; appendages narrow, glabrous, white, entire to crenulate or even sharply toothed; fifth gland from a mere apiculation to a linear

segment half as long as the lobes; sinus narrowly U-shaped, depressed ca. ⅓ to base of involucre; bracteoles minute, linear; staminate flowers 3–7 per cyathium; androphores glabrous, 0.9–1 mm. long; gynophore glabrous below, crisply hairy above, exserted and mostly reflexed; ovary 3-lobed, densely strigose; styles ca. 0.2 mm. long, expanded at the apex, entire to deeply emarginate; capsule 1.4–1.9 mm. long, 3-angled, widest near the base, strigose, the basal angles with spreading hairs; seeds sharply quadrangular, 1.2–1.4 mm. long, 0.7–0.8 mm. tangentially, ca. 0.6 mm. radially, radially narrowly ovate to oblong-ovate, base truncate, apex acute, facets with shallow irregular pits to subregular low transverse ridges, coat mottled whitish brown and brown, the bottom of the pits darker colored than the ridges.—PLATE 662B.

South Dakota and Wyoming, south to Chihuahua, Coahuila, Durango, and Zacatecas, west to Arizona (MAP 28). Representative specimens seen: SOUTH DAKOTA. Fall River Co.: Hot Springs, Aug. 27, 1909, *Petersen* (NY). Stanley Co.: Missouri Valley near Fort Pierre, June 19, 1839, *Geyer* in part (US). Black Hills, Aug., 1893, *Thornber* (M). NEBRASKA. Dawes Co.: Whitney, Aug., 1890, *Bates* (G). Webster Co.: Red Cloud, July 22, 1904, *Bates* (G). KANSAS: Ellis Co.: near Hays, *Rydberg & Imler 1244* (NY). Graham Co.: Bogue, *Imler 5* (NY). Greeley Co.: near Tribune, *Rose & Fitch 17086* (NY). Hamilton Co.: 5 miles east of Kendall, *Rydberg & Imler 1065* (M, NY). Lincoln Co.: *A. S. Hitchcock 472a* (G, M, NY). Logan Co.: on Turkey Creek, east of McCallaster, *Rydberg & Imler 1153* (NY). Meade Co.: Meade, Aug., 1892, *A. S. Hitchcock* (NY). Osborne Co.: Osborne City, *Shear 119* (G). Riley Co.: hills, *Norton 472* (G, M, NY). Rooks Co.: Rockport, July 20, 1889, *Bartholomew* (M). Seward Co.: Liberal, July, 1892, *A. S. Hitchcock* (NY). Wyandotte Co.: Wyandotte, Aug. 16, 1896, *Mackenzie* (NY). OKLAHOMA. Blaine Co.: near Canton, *G. W. Stevens 835* (G). Texas Co.: 25 miles southeast of Guymon, *Stratton 459* (M). Woods Co.: Alva, *G. W. Stevens 1602* (G, NY). TEXAS: Brewster Co.: frequent on Sul Ross Campus, Alpine, *Warnock T589* (US). Culberson Co.: Walker Ranch, *Cory 1941* (G). El Paso Co.: El Paso, *M. E. Jones 4195* (G, I, NY in part, O). Gaines Co.: 3.9 miles south of Seminole, *Cory 16617* (W). Hudspeth Co.: Eight Mile Well, *Cory 1946* (G). Kerr Co.: 5.8 miles southeast of Mountain Home, *Cory 19317* (G). Martin Co.: Stanton, June 14, 1900, *Eggert* (M). Pecos Co.: 5¼ miles southeast of Fort Stockton, *Cory 15295* (W). Reeves Co.: *Cory 1949* (G). Ward Co.: Barstow, *Tracy 8169* (G, M, Mo, NY). WYOMING: Laramie Co.: Cheyenne, *Nelson 2727* (G, M, NY). COLORADO. Fremont Co.: below Canyon City, *M. E. Jones 786* (I, M, NY). Larimer Co.: Fort Collins, *Anonymous 4020* (NY). Otero Co.: 15 miles northeast

of La Junta, *Rollins 1876* (M, NY, W). Pueblo Co.: Pueblo, *Baker, Earle & Tracy 6* (G, M, NY). Weld Co.: Sec. 18, T.10 N, R.65 W, *Muir 149* (G). Yuma Co.: Wray, 1907, *Shantz* (NY). New Mexico. Catron Co.: Beaverhead, Datil Forest, *Eggleston 20424* (G). Chaves Co.: south of Rosswell, *Earle 290* (M). Doña Ana Co.: Mesilla Valley, *Wooton & Standley 3273* (M). Lincoln Co.: Gray, *Skehan 51* (G, NY). Santa Fe Co.: Santa Fe at base of hills, *Fendler 797* (G, M). San Miguel Co.: near Pecos, *Standley 4939* (G, M, NY). Sierra Co.: Kingston, *Metcalfe 1006* (M). Arizona: Cochise Co.: Douglas, *Thornber 7111* (T); near Douglas, *Harrison & Kearney 6114* (US); Paradise, Chiricahua Mts., *Blumer 1690* (G, M, NY, US); Benson, *Harrison 8224* (US); Bisbee, Aug. 28–30, 1910, *Pilsbry* (Ph). Pima Co.: Rosemont, Santa Rita Mts., *Thornber 9055* (T). Santa Cruz Co.: near Nogales, *Peebles, Harrison, & Kearney 5564* (US); Patagonia Mts., *Kearney & Peebles 10140* (US). MEXICO: Chihuahua: near Chihuahua, *Pringle 327* (G, US); southwest of El Paso, near Comalitos, *Thurber 731* (G, M). Coahuila: 1 mile south of Hermanas, *Johnston 7061* (G); 4 miles east of Cuatro Cienegas, *Johnston 7123* (G); Saltillo, Nov. 2–5, 1898, *Ed. Palmer 567* (G, US); Torreon, Oct. 13–20, 1898, *Ed. Palmer 489* (G, US); Jimulco, *Pringle 80* (G, US); Ramos Arizpe between Hipolito and Sacramento, *Wynd & Mueller 77* (G, M, US). San Luis Potosi: near San Luis Potosi, *Parry & Ed. Palmer 817½* (G, M). Zacatecas: 5 miles south of Majoma, *Johnston 7387* (G); near Conception del Oro, Aug. 11–14, 1904, *Ed. Palmer 319* (G). Durango: 26 miles west of Mapimi, *Johnston 7779* (G); Santiago Papasquiaro, Apr. & Aug., 1896, *Ed. Palmer 43* (G, M, US); Tepehuanes, June 4–25, 1906, *Ed. Palmer 299* (US).

48. Euphorbia Chamaesyce L., Sp. Pl. **1:** 455. 1753. Type: Jamaica, *P. Browne* (Linnaean Herb., not seen; photograph F!, W!; fragment F!, the right-hand specimen). An average member of the species.—*Tithymalus Chamaesyce* (L.) Moench, Meth. Pl., 666. 1794.—*Anisophyllum Chamaesyce* (L.) Haw., Syn. Pl. Succ., 160. 1812.—*E. Chamaesyce* L. A. *eu-chamaesyce* Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 454. 1917.

E. prostrata Aiton, Hort. Kew. **2:** 139. 1789. Type: "*Nat*[*ive*] of the West Indies. *Cult.* 1758, by Mr. Philip Miller" (British Museum if extant.) Boissier in DC. Prod. **15** (**2**): 47. 1862; Boissier, Icon. Euph., t. 17. 1866, poor; Fiori & Paoletti, Fl. Ital. Illustr., 303, t. 2572. 1901[1]; Thellung, Bull. Herb. Boiss., ser. 2, **7:** 768–770. 1907; Thellung in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 476–479. 1917.—*E. serpillacea* Willd. ex Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 26. 1860, as

[1] Date fide Thellung, Bull. Herb. Boiss., ser. 2, 7: 769. 1907.

synonym of *Anisophyllum prostratum*, and Baillon, Adansonia **1:** 116. 1860–1861 as synonym of *E. prostrata*.—*Anisophyllum prostratum* (Aiton) Klotzsch & Garcke, Abh. Akad. Berlin, Phys. **1859:** 26. 1860.—*Tithymalus prostratus* (Aiton) Bubani, Fl. Pyren. (ed. Penzig) **1:** 116. 1897.—*Chamaesyce prostrata* (Aiton) Small, Fl. Se. U. S., 713, 1333. 1903.

E. callitrichoides HBK., Nov. Gen. et Sp. **2:** 52 (quarto). 1817. Type: Vera Cruz, Mexico (Herb. Mus. Paris, not seen; photograph G!). Referred here, apparently correctly, by Boiss. in DC. Prod. **15** (**2**): 47. 1862.

E. tenella HBK., Nov. Gen. et Sp. **2:** 53(quarto). 1817. Type: ad Ripas Orinoci prope Maypures et Carichana, Venezuela (Herb. Mus. Paris, not seen; photograph G!; fragment of isotype from Berlin at M!).

E. prostrata β *vestita* Engelm. ex Boiss. in DC. Prod. **15** (**2**): 47. 1862. Type: New Orleans, Louisiana, *Hale* (Ge!; photographs G!, W!). Scarcely more vestite than usual and of no consequence.

E. stictospora Engelm. var. *texensis* Millsp., Bot. Gaz. **26:** 266. 1898. Type: southern Texas, 1894, *Heller 1913* (F 196483!).—*Chamaesyce stictospora guadalupensis* Small, Fl. Se. U. S., 714, 1334. 1903.—*C. stictospora* var. *texensis* (Millsp.) Fedde in Just, Bot. Jahrb. **32** (**1**): 368. 1905.

Chamaesyce malaca Small, Fl. Se. U. S., 713, 1333. 1903. Type: Kerrville, Kerr County, Texas, June 26–30, 1894, *A. A. Heller 1918* (NY!; photographs G!, W!; isotypes F!, G!, M!).—*E. malaca* (Small) Little in Jeffs & Little, Univ. Okla. Biol. Surv. Pub. **2** (**2**): 70. 1930 (Prelim. List Ferns & Seed Pl. Okla.).

Boiss. in DC. Prod. **15** (**2**): 47. 1862, lists two additional extralimital synonyms which have not been confirmed.

Annual; stems prostrate to decumbent, few to several, mostly 1–1.5 mm. thick, crisped-hairy to glabrate, at least the young tips vestite and often subtomentose, internodes rarely up to 4 cm. long, average on main stems about 1 cm. long, on short lateral branchlets shortened to as little as 2 mm.; leaf-blades broadly elliptical to elliptic-oblong, obovate-spatulate or even ovate, 3–11 mm. long, mostly 4–8 mm. long, margin often serrulate, base mostly inequilateral, upper surface mostly glabrous, lower surface finely and crisply hairy, often glabrate; petioles ca. 1 mm. long; stipules with short hairs, triangular-subulate, often lacerate above, 0.5–1 mm. long, dorsal usually distinct, ventral often united; peduncles 1–2 mm. long, with short hairs or sometimes glabrous; cyathia solitary at the nodes but mostly on short-noded lateral branchlets; involucres 0.6–0.9 mm. in diam., obconical, tapering to the peduncle, with scattered crisped hairs or glabrous outside, glabrous inside except on the lobes and stipes; lobes rounded-triangular, about equaling the glands, hairy; glands transversely oval to oblong,

0.15–0.3 mm. long, usually depressed in the middle; appendages white, glabrous, from about as wide as to twice as wide as the gland; sinus U-shaped, somewhat depressed, glabrous in the lower half; fifth gland filiform, ¼–⅔ as long as the lobes; bracteoles nearly wanting, reduced to 2–3, glabrous, filiform; staminate flowers 4 per cyathium; androphores glabrous, 0.9–1.1 mm. long; gynophore hairy above or glabrous, exserted and usually reflexed; ovary roundly 3-lobed, densely white-hairy; styles bifid nearly to the base, 0.2–0.3 mm. long, glabrous, slightly clavate; capsule sharply 3-angled, 1–1.4 mm. long, wider below the equator, with crisped hairs persistent on the backs of the carpels but more or less deciduous on the sides; seeds sharply quadrangular, 0.9–1 mm. long, 0.6–0.7 mm. tangentially and radially, radially ovate, facets traversed by low narrow slightly irregular ridges which scarcely pass through the angles, ventral facets concave, dorsal plane to convex, coat white, microreticulate, often little concealing the brown to gray testa.—PLATES 660C and 668A.

Introduced in Massachusetts and Virginia; South Carolina, Florida, Alabama, Louisiana, Missouri, Nebraska, Oklahoma, Texas, and Arizona; introduced in the Old World (MAP 44). Representative specimens seen: MASSACHUSETTS. Middlesex Co.: Malden, on cotton waste, Sept. 20, 1890, *Collins* (NE). VIRGINIA. James City Co.: Williamsburg, stone steps of old house, *Grimes 4640* (G, NY). SOUTH CAROLINA. Charleston Co.: Charleston, *B. L. Robinson 237* (G). FLORIDA. Nassau Co.: Fernandina, Oct. 29, 1890, *A. S. Hitchcock* (M). Duval Co.: Jacksonville, 1880, *Curtiss* (M). St. Johns Co.: streets in St. Augustine, *Curtiss 6426* (G, M, NY). Volusia Co.: Green Mound (shell-midden) 5 miles south of Daytona Beach, *J. K. Small, J. W. Small & DeWinkeler 10568* (NY). Monroe Co.: Garden Key, Dry Tortugas, *Lansing 2502* (NY). Lee Co.: shell mounds, Marco, *A. S. Hitchcock 318* (G, M, NY). Leon Co.: sidewalk on Tennessee St., Tallahassee, July 13, 1926, *Harper* (NY). Gulf Co.: Apalachicola, "Herb. Chapman" (M, NY). ALABAMA. Jefferson Co.: Birmingham, in garden on 7th St. S., *H. E. Wheeler 1209* (G, NY). Montgomery Co.: on slag ballast on L. & N. Railroad about 2 miles southwest of Montgomery, *Harper 30* (G, NY, Ph). Mobile Co.: Mobile, *Dukes 11* (G). MISSOURI. Jackson Co.: Courtney, *Bush 8630* (NY). LOUISIANA. Rapides Co.: near Alexandria in cultivated ground, not common, *Ball 637* (G, M, NY). Orleans Co.: streets of New Orleans, *Hale* (M). Terrebonne Co.: Houma, July, 1912, *Wurzlow* (NY). NEBRASKA. Kearney Co.: Minden, Sept. 1, 1933, *Hapeman* (NY). Harlan Co.: Orleans, *Bates 3633* (NY). OKLAHOMA: Kay Co.: Tonkawa, *G. W. Stevens 1864* (G). Woods Co.: near Fairvalley, *G. W. Stevens 1640* (G). Blaine

Co.: near Canton, *G. W. Stevens 833* (G, M). Rogers Co.: Verdigris, *Bush 537* (G, NY). Oklahoma Co.: Oklahoma City, north Canadian River bottom, *Demaree 13252* (G, NY). Murray Co.: Turner Falls, Arbuckle Mountains, *Demaree 13204* (NY). Comanche Co.: near Fort Sill, *J. Clemens 11674* (G, M). Texas. Anderson Co.: Palestine, *Cory 25414* (G). Austin Co.: in clayey soil near Industry, July, 1844, *Lindheimer* (G, M). Bexar Co.: San Antonio, *Wilkinson 52* (M). Calhoun-Matagorda Co.: Matagorda Bay, *Robbins 10* (M). Cameron Co.: Harlingen, *Tracy 9123* (G, M, NY). Colorado Co.: Columbus, common along river, *Bush 431* (G, M, NY). Comal Co.: New Braunfels, 1846, June, *Lindheimer III, 533* (G, M). Dallas Co.: Dallas, June, 1874, *Reverchon* (G). Duval Co.: San Diego, *Croft 168* (NY). Edwards Co.: Substation no. 14, yard, *Cory 6763* (G); 22 miles south of Rocksprings, *Cory 3197* (G). Hays Co.: San Marcos, *E. J. Palmer 12096* (M). Hidalgo Co.: Donna, *Tracy 9124* (G, M, NY). Lampasas Co.: Lampasas, Sept. 21, 1892, *Plank* (NY). Llano Co.: Llano, Aug., 1848, *Lindheimer* (M). Parker Co.: Weatherford, *Tracy 7858* (G, M, Mo, NY). Randall Co.: north of Canyon City, Aug. 13, 1900, *Eggert* (M). Red River Co.: Clarksville, Sept. 25, 1894, *Plank* (NY). Starr Co.: Rio Grande City, *Neally 222* (US). Tarrant Co.: Fort Worth, *Tracy 8167* (G, M, Mo, NY). Taylor Co.: Buffalo Gap Hills, Sayles Ranch, *Cory 1966* (G). Travis Co.: Austin, *Bogusch & Molby 5508* (O). Valverde Co.: 48 miles south of Ozona on Comstock Road, *Ferris & Duncan 3013* (M, NY). Webb Co.: Laredo, July 26, 1882, *Letterman* (M). Wilson Co.: Sutherland Springs, 25 miles southeast of San Antonio, *Ed. Palmer 1196* (G, M). Arizona. Pinal Co.: 8 miles west of Florence, *Peebles & Kearney 264* (A). Pima Co.: Tucson, Sept. 30, 1892, *Toumey* (C). Santa Cruz Co.: Santa Cruz River at La Noria, *Mearns 1168* (US).

This species is native in the New World where it is widely distributed. It is introduced generally in the Old World.

Several additional synonyms are cited by Boissier and Thellung. All these are, of course, later than *Euphorbia Chamaesyce* and are extra-limital. Since no authentic material of any of these supposed synonyms has been available no opinion as to their identity will be offered.

Small separated *Chamaesyce malaca* from *C. prostrata* as follows:

"Capsules pubescent along the angles. .35. *C. prostrata*
Capsules pubescent all over but mainly so below the middle. . .36. *C. malaca*"

The capsules of *C. prostrata* are glabrate on the sides of the carpels. Those with slightly more persistent hairs on the sides

of the carpels constitute *C. malaca.* The character does not hold. Small described the leaves of *C. malaca* as "1–1.5 cm. long", and those of *C. prostrata* as "4–6 mm. long". The leaf-length given for *C. malaca* was evidently taken from a juvenile specimen of *Euphorbia humistrata* collected at Verdigris, Oklahoma (Indian Territory), *B. F. Bush 537* (NY) which has the leaves as long as ca. 1.5 cm. But even the type of *Chamaesyce malaca* has leaves of mostly average size for what Small called *C. prostrata.*

The placing in this paper of *E. prostrata* Aiton in the synonymy of *E. Chamaesyce* needs comment. There has been no opportunity to examine any authentic material of the former. Aiton's description is so vague as to be applicable to more than one species. As a consequence of these circumstances there is no assurance that *E. prostrata* is here correctly interpreted. In absence of any basic evidence, it has seemed wise to continue the customary application of the name *E. prostrata.*

Customarily the name *E. Chamaesyce* is applied to an entity native in the Mediterranean region and eastward into Asia. Consequently it had not occurred to me to consider the possibility that the name might properly belong to a plant native in the New World. There seems to be only one author, Swartz, Obs. Bot. Pl. Ind. Occ., 196. 1791, who has applied the name to any New World plant and this was ignored as a mere casual misapplication. However, while browsing through the specimens at Field Museum, Chicago, in Sept., 1939, I came upon a photograph of the specimen in the Linnaean herbarium and fragments from the same specimen. The photograph shows that the sheet upon which the specimen is mounted bears the customary abbreviation used by Linnaeus to indicate specimens collected by Patrick Browne, hence the specimen was collected in Jamaica. Jackson's Index to the Linnean Herbarium shows that the specimen was in Linnaeus' herbarium in 1753. The photograph and fragments had been filed at Field Museum in their proper place under Ind. Occ. in the folder of *E. prostrata* Aiton! There is no doubt that *E. Chamaesyce*, as represented in the Linnaean herbarium, is identical with *E. prostrata* as usually interpreted. This is not a new discovery, for, as I discovered in January, 1940, Thellung, in Ascherson & Graebner, Syn.

Mitteleur. Fl. **7**: 477. 1917, notes in the synonymy of *E. prostrata*: "*E. Chamaesyce* P. Browne in Linné's Herbar (von Jamaica) nach B. Daydon J a c k s o n briefl." Thellung then enumerates a few authors who have applied the name *E. Chamaesyce* in the sense of Linnaeus' herbarium to the plant naturalized in the Mediterranean region.

One of the fundamental rules to be followed in the typification of a Linnaean species is that the Linnaean specimen is to be taken as type, except in extraordinary cases, if he had it in his herbarium at the time the species in question was published and if it conforms to his diagnosis. Exceptional cases are rare and require a full and elaborate explanation to establish acceptable grounds for refusing to accept the Linnaean specimen as type. The force of custom is shown by the careful and extended explanation deemed necessary by Merrill, Bull. Torr. Bot. Club **60**: 633–638. 1933, to justify his rejection of the Linnaean specimen as type of *Poa malabarica* L. In order to determine whether there were any possibility that Linnaeus casually applied the name *E. Chamaesyce* to a plant received perhaps long after the concept had been formulated, his Hortus Cliffortianus was examined, since it was among the earlier references cited in the Species Plantarum. In Hort. Cliff., 198. 1737, the species appears as follows:

> "12. Euphorbia inermis, foliis oppositis oblique cordatis serrulatis uniformibus, ramis alternis, floribus solitariis."
> Several synonyms were cited, then:
> "*Crescit in agris & vineis aridis & arenosis* Siciliae, Italiae, Galliae Narbonensis & Jamaicae. *Corymbus in hac nullus; folia omnia uniformia, aequalia; flores ex alis ubique, albi, tetrapetali; caules alternatim ramosissimi. Folia in Europaea magis orbiculata, in Americana oblonga & saepius macula fusca in medio notata; caulis quam arctissime terrae appressus.*"

Since Jamaica and the plant of America are specifically mentioned in 1737, it was no casual chance whereby the name was applied to a New World plant in Linnaeus' herbarium. Consequently *Euphorbia Chamaesyce* must be typified by the Linnaean specimen. This is the plant commonly known as *E. prostrata* Aiton, which is native of the New World but now widely introduced in tropical regions. The numerous specimens in various herbaria which I have named *E. prostrata* Aiton must now be called *E. Chamaesyce* L.

Thellung, in Ascherson & Graebner, Syn. Mitteleur. Fl. **7:** 455 footnote 2, 1917, stated "Das Original der *E. Chamaesyce* (vielleicht von Loefling aus Spanien stammend?) gehört gleichfalls zur Abart *canescens* [of *E. Chamaesyce*] (B. Daydon Jackson briefl.)". I do not understand what Jackson could have been taking as type unless there were two specimens in the Linnaean Herbarium.

49. Euphorbia laredana Millsp., Pittonia **2:** 88. 1890. Type: Sandy plains, Laredo, Webb County, Texas, July 28, 1888, *C. G. Pringle 2074* (F 197395!; photographs G!, W!; isotype NY!).—*Chamaesyce laredana* (Millsp.) Small, Fl. Se. U. S., 709, 1333. 1903.

Annual, more or less pilose-tomentose throughout; stems several to many, 10–20 cm. long, stout (1.5 mm. diam.) toward the base, internodes to 1 cm. long; leaf-blades extremely oblique even to the small upper ones, ovate to elliptic-oblong (distorted by the obliquity) 3–5 mm. long, margin entire or the large juvenile leaves with a few low discrete teeth, petioles less than 1 mm. long; stipules minute and obscured by the tomentum; peduncles ca. 0.5 mm. long; cyathia solitary at the nodes; involucres tomentose without, glabrous within except above, short-campanulate, cuneate to the peduncle, 1 mm. or less in diam., green-veined opposite the lobes; lobes deltoid, equaling or slightly exceeding glands, hairy; glands transversely oblong, 0.2–0.3 mm. long, yellowish; appendages absent to slightly wider than the glands; fifth gland a minute papilla; sinus slightly depressed and with long hairs; bracteoles reduced to one radial appendage opposite each gland, adnate to the involucre for half its length, entire to one- or two-parted to the base, hairy above; staminate flowers 3–5; androphores glabrous, 1 mm. long, included; gynophore tomentose above, glabrous below, exserted and reflexed at maturity; ovary sharply three-angled, tomentose, styles bifid, less than 0.2 mm. long; capsule glabrate on the sides of the carpels, the backs usually persistently tomentose, sharply three-angled, 1.3–1.5 mm. long, 1.5 mm. diam.; seeds sharply quadrangular, 1.1–1.2 mm. long, 0.6 mm. radially and tangentially, ovate to narrowly ovate radially, base concave-truncate, facets concave, with subregular, round, transverse ridges including the angles, tops of ridges and angles frosted white, brown between.—Plate 662A.

Sandy sites in Webb, Starr and Hidalgo Counties, Texas (Map 30). Representative specimens seen: Texas. Webb Co.: Laredo, *Pringle 3747* (C, F, G, NY, O, P). Starr Co.: 5 miles north of Rio Grande City, *Clover 1363* (NY). Webb Co.: Laredo, Aug., 1899, *Mackenzie 50* (NY). Hidalgo Co.: Sullivan City,

Runyon 2541 (W). For citation of additional specimens see Bull. Torr. Bot. Club **63:** 431. 1936.

This species is very closely related to *E. Chamaesyce.* The following specimen, though rather intermediate, is referred to *E. Chamaesyce:* Laredo, Webb Co., Texas, July 26, 1882, *Geo. W. Lettermann* (M).

Excluded and Doubtful Species

Anisophyllum dentatum (Michaux) Haw., Syn. Pl. Succ., 162. 1812, is a member of *Euphorbia* subgenus *Poinsettia.*

Aplarina prostrata Raf., New Fl. N. Amer. **4:** 99. 1838, proposed without reference to *Euphorbia prostrata* Aiton. Not recognizable. Said to grow in Pennsylvania.

Aplarina? microphyla Raf., op. cit., 100. Not recognized from the description. From Louisiana and Texas.

Chamaesyce exstipulata (Engelm.) Rydb., Bull. Torr. Bot. Club **40:** 53. 1913, is a member of *Euphorbia* subgenus *Agaloma* (including section *Zygophyllidium*).

Chamaesyce oregonensis Millsp. ex Arthur, N. Amer. Fl. **7:** 766. 1926; Man. Rusts U. S. & Canada, 309. 1934. Merely listed as the host of a rust.

Euphorbia grisea Engelm. ex Boiss. in DC. Prod. **15** (**2**): 41. 1862. Reported from Texas by Cory, Bull. Texas Agr. Exper. Sta. **550:** 65. 1938.[1] I have seen no material to support this report which may be based on the supposition of Coulter, Contr. U. S. Nat. Herb. **2:** 388. 1894 (Bot. West. Texas) that this species occurred in Texas.

Euphorbia humifusa Engelm. ex Wiegand, Bot. Gaz. **24:** 51. 1897, in key, *lapsus* for *E. humistrata* Engelm.

Euphorbia hypericifolia L. var. *prostrata,* var. *multiflora,* and var. *simplex* Raf., Med. Fl. U. S. **1:** 183. 1828, *nomina nuda.*

Euphorbia ludoviciana Featherman, Ann. Rep. Geol. Surv. Louisiana **2:** 71. 1871, not Raf., Fl. Ludovic., 111. 1817. An isotype, at Gray Herbarium, of this species, shows it to be *Phyllanthus caroliniensis* Walter.

Euphorbia oregonensis Millsp. ex Seymour, Host Index Fungi N. Amer., 462. 1929. Merely listed as the host of a rust.

Euphorbia Peplis L., Sp. Pl. **1:** 455. 1753, has been found on ballast but has not become established and hence is excluded.—*Tithymalus Peplis* (L.) Scop., Fl. Carn. ed. 2, **1:** 340. 1772.—*Anisophyllum Peplis* (L.) Haw., Syn. Pl. Succ., 159. 1812.—*Chamaesyce Peplis* (L.) Prokhanov, Consp. Syst. Tithym. Asiae Mediae, 15, 1933.

Euphorbia setigerus [sic] Benth. ex Frick, Euphorbia Review **2:** 10. 1936, with brief description, is evidently a garbled account of some weedy species of *Euphorbia* inadvertently associated with the irrelevant name *Eremocarpus setigerus* Bentham. According to Frick in a letter, the account was drawn from a newspaper report.

Xamesike deltifolia Raf., Aut. Bot., 98. 1840; not recognized. Florida. Specimen at Paris according to his notes shown me by Croizat.

Xamesike glauca Raf., op. cit., 97. Perhaps a prostrate individual of *Euphorbia maculata.* Kentucky, Virginia.

[1] Published Jan. 18, 1938 according to Cory in letter filed at Gray Herbarium.

Xamesike gracilis (Elliott) Raf., op. cit. 98; based on *Euphorbia gracilis* Elliott. Belongs to *E.* subgenus *Agaloma* (including section *Tithymalopsis*).

Xamesike hypericifolia Raf. var. *sanguinolenta* Raf., l. c. Probably equals *Euphorbia maculata* L. Pennsylvania.

Xamesike hypericifolia Raf. var. *parviflora* Raf., l. c. Identity uncertain. Alabama.

Xamesike micranthes Raf., l. c. Identity uncertain. Louisiana to Alabama.

Xamesike microphyla (Raf.) Raf., l. c.; based on *Aplarina? microphyla* Raf.

Xamesike prostrata (Raf.) Raf., op. cit., 99; based on *Aplarina prostrata* Raf.

Gandoger, Fl. Europae 20: 142. 1890 has described and given binomials under *Euphorbia* sect. *Anisophyllum* to three supposedly new entities from the United States (Pennsylvania, Nebraska, and Missouri). In addition he has named (as binominals) and described a total of 10 segregates of 2 species native in the United States but introduced into Europe. It seems best to continue the custom of ignoring all names published in this work of Gandoger's. The technical nomenclatural justification for this action at least in the case of *Euphorbia* is that the first of Gandoger's binomials under this genus were the names of the various subdivisions, in the case pertinent here, *Anisophyllum*. Also, the structure of the work indicates that the new binomials were subdivisions of species which form of nomenclature is inadmissible according to the International Rules of Botanical Nomenclature, Article 28.

List of Exsiccatae

The collectors' numbers are printed in *italics;* unnumbered collections are indicated by a dash. The numbers in parentheses are those of species and varieties treated in this revision.

Abrams, LeRoy. *1381* (25); *2661* (35a); *2952* (35b); *2990* (35a); *3187* (26b); *3789* (35b); *4097* (37); *4132* (45); *4178*, *4652* (35a); *5341* (3a).
Abrams, LeRoy, and E. A. McGregor. *206* (31).
Allen, J. A. — (36, 45).
Allison, A. *148* (13).
Anderson, A. P. *777* (45); *1537* (13).
Anderson, L. E. *4479* (13).
Andrews, L. — (14, 45).
Antisell, T. — (43).
Armer, Annie A. *5390* (30).
Arsène, G. *18987* (35a).
Arthur, J. C. *79* (13).
Ashcroft, G. B. — (13).

Baker, C. F. — (35a, 36); *195* (35a); *453* (36); *1274* (35a).
Baker, C. F., F. S. Earle & S. M. Tracy. *5* (36); *6* (47); *608* (35a).
Baker, H. P. — (7b).

Baker, M. S. — (35a).
Ball, C. R. *405* (13); *637* (48); *959*, *1257* (36); *1259* (13); *1275* (30).
Ballard, C. A. — (45); *161* (36); *526* (45); *527*, *2604* (36); *2682*, *2734*, *2774*, *2902* (35a); *3051* (36).
Barrus, M. F. *7* (26a).
Bartholomew, Elam. — (47).
Bartlett, G. H. — (1).
Bartlett, H. H. *10559* (23).
Bartram, E. B. *326* (22a); *1793* (1); *3053* (45).
Bassett, G. W. — (13).
Batchelder, C. F. — (45).
Bates, G. M. *2988* (36)
Bates, J. M. — (32a, 47); *3633* (48); *5025* (45).
Beal, Mary. — (26b, 28).
Beals, Mrs. Ida M. — (18, 31).
Bean, R. C. — (45).
Bean, R. C., F. W. Bird & C. H. Knowlton. — (1).
Bechtel, A. R. *8409* (45).
Becraft, R. J., and C. P. Starr. *385* (35a).
Benke, H. C. *5034* (18).
Benner, W. M. *5418* (45); *7008* (13); *7335* (45).
Bergman, H. F. *690* (36); *1835* (7b); *2411* (30).
Berlandier. *140* (30).
Bicknell, E. P. — (45).
Bigelow, J. M. — (18, 20).
Biltmore Herb. *403a*, *403b*, *403d* (13); *407b* (45); *3838a*, *3838b*, *3838c*, *3838d* (1); *3844a* (12); *3848a* (30); *5895b* (29); *6415* (9).
Bissell, C. H. — (14); *528* (1); *529* (13).
Bissell, C. H., and D. H. Linder. *21755* (1); *21757* (14).
Blake, J. — (30).
Blake, S. F. — (45); *1813*, *2033* (14); *3158* (36); *5651* (1); *7776* (12).
Blanchard, W. H. — (45).
Blankinship, J. W. *116* (36).
Blankinship, L. A. — (36).
Blewitt, A. E. *848* (14); *849* (1); *850* (13).
Blomquist, H. L. — (13).
Blumer, J. C. *27* (35a); *1690* (47); *1691* (31).
Bodin, J. E. — (7a, 45).
Bogusch, E. R., and Molby. — (31); *5508* (48).
Bolander, H. N. *186* (35a).
Bondy, Earle. *291* (7a).
Bonpland, A. *403* (16); *406* (5).
Boott, Wm. — (45).
Bracelin, Mrs. H. P. *564* (35a).
Brandegee, Katharine. — (4).
Brandegee, T. S. — (4, 8, 10, 17, 22a, 35a, 35b, 39); *316* (35a); *615* (26a).
Brannon, M. A. — (36).
Braunton, E. *1178* (35a).
Bray, W. L. *276* (19).
Brewster. — (1).
Britton, N. L. *330* (15).
Broadhead, G. C. — (7a).
Brown, A. *178* (7a).
Brown, H. E. *541* (35a).
Bunker, Mary. — (32a).
Burgess. — (30).
Burk. — (30).
Burk, Myrel. *904* (36)
Burnham, S. H. — (14, 36, 45).
Bush, B. F. — (45); *75* (7a); *136*, *412* (30); *431* (48); *500* (36); *506* (7a); *533* (36); *536* (45); *537* (46); *650* (31); *949* (13); *1140*, *6487a* (7a); *7068* (45); *8630* (48); *10336a* (7a); *11824* (35a); *12324* (46); *15125* (45); *15733*, *15743*, *15918* (13).
Butters, F. K. — (13, 45).

Campbell, Jennie E. — (7b, 36).
Cangemi, L., & L. Andrus. *1* (5).
Carpenter. — (30).
Carter, L. A. (Mrs.). — (13).
Carter, W. R. — (14, 36).
Castle, H. *104* (45).
Chamberlain, E. B. —, *228* (45).
Chandler, B. F. — (13).
Chandler, H. P. *7026* (31).
Chapman. — (45, 48).
Chase, Agnes. —, *1896*, *2111* (1).
Chase, V. H. — (13); *205* (1); *696* (45).
Chesnut, V. K., & E. R. Drew. — (35a).
Christinsen, Lingo. *10039* (36).
Churchill, J. R. — (14, 45); *545* (1).
Clark, June A. *144* (35a).
Clary, Marjorie D. *655* (26b).
Clemens. — (35a).
Clemens, J. *11674* (48).
Clemens, Mrs. J. *11671* (7a).
Clements, F. E. *152* (7b); *272* (9); *276*, *2587* (36); *2717* (30); *2751* (13).
Clements, F. E., & E. S. Clements. *25* (36).
Cleveland, D. —, *904* (35b).
Clevenger, C. H. — (13).
Clevenger, J. F. — (13).
Clifton, R. L. *3183* (32a).
Clokey, I. W. *7183*, *7184*, *7578* (32a).

Clover, E. U. *356* (5); *783* (15); *1363* (49); *1364* (30); *1475*, *1524*, *1537* (15).
Clute, W. N. *9* (32); *91* (32a); *257* (1).
Cocks, R. S. *3625* (30).
Coffman, Coral Fleenor. — (45).
Collins, F. S. — (1, 48); *981*, *1176* (45); *2872* (1).
Collins, G. N., T. H. Kearney & J. H. Kempton. *145* (22a).
Collins, J. F., & M. L. Fernald. — (14).
Collom, Mrs. Rose E. — (39); *33* (25); *314* (10).
Commerson. *238* (16b).
Commons, A. — (13, 45).
Congdon, J. W. *75* (35b).
Conklin, J. — (7b).
Constance, L., & C. D. Jacobs. *1418* (35a).
Cook, H. C. — (13).
Cooper, H. L. *111* (36).
Cory, V. L. *508* (18); *1907* (17); *1914*, *1915* (18); *1919*, *1921* (20); *1922* (4); *1926* (31); *1927* (26c); *1935* (31); *1941* (42, 47); *1942* (42); *1946*, *1949* (47); *1956* (36); *1959* (28); *1960* (33); *1964* (32b); *1966* (48); *2273* (18); *3188* (19); *3191* (32b); *3197* (48); *3201* (42); *4879* (36); *6020* (32a); *6763* (48); *6906* (39); *7005* (12); *7006*, *7329* (41a); *8729* (32a); *8898* (41a); *9264* (43); *9294* (20); *10046*, *10224*, *11547*, *11812* (45); *13130* (7b); *15295* (47); *15617* (7a); *16037*, *16313* (7b); *16617* (47); *18593B* (18); *18595*, *19308* (32a); *19310* (41a); *19317* (47); *20383* (45); *21208* (23); *22451* (45); *23954*, *24387* (41a); *24574* (45); *24700* (36); *25096* (29); *25414* (48); *25547* (30); *26319* (32a); *26452* (26c); *26701* (19); *27315* (36); *27404* (41a).
Coues, Elliott, & Ed. Palmer. *264* (25); *531* (10).
Coulter, J. M. — (35a).
Coville, F. V. *10* (30).
Coville, F. V., & F. Funston. *735* (31); *1008* (24); *1081* (3a).
Cowen, J. H. *126* (32a).
Creighton, H. B. — (31).
Croft, Mary B. *168* (48); *202* (31).
Cronemiller, F. P. *663* (35a).
Curtiss, A. H. — (16b, 29, 45, 48); *2469* (29); *2486* (15); *2496* (16a); *2496* (16b); *5395* (16a); *5849* (16b); *5959* (29); *6426* (48); *6670* (12).
Curtiss, A. W. — (45).
Cushman, J. A. — (1).
Cuthbert, A. — (13); *707* (1).
Cutler, H. C. *664* (39); *723* (26c); *2286* (4).

Daniels, F. P. — (45).
Darlington, Wm. — (13).
Davis, J. J. — (1).
Davis, John. *955* (13); *1419* (45).
Davy, J. B. *1883* (31).
Day, M. A. *42*, *87*, *376* (14).
Dayton, W. A. *486* (35a).
Deam, C. C. — (45); *5206* (1); *13935*, *18980*, *21389* (45); *23989*, *24101*, *24230*, *24270*, *24344* (46); *25691*, *26533* (45); *26597*, *26745* (46); *26793* (13); *29566*, *29862* (45); *32083* (13); *32212* (45); *32533* (14); *32671* (45); *33357* (30); *34640* (45); *37495*, *37598* (13); *37789*, *37890* (45); *38092*, *40038*, *41122*, *41514* (46); *41921* (45); *42635*, *48035* (46); *49615* (45); *50800*, *50817*, *51351*, *51438* (46); *52655*, *52954* (45); *55400*, *56707*, *57370* (36).
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Deane, G. C. — (26a).
Deane, Walter. — (1, 45).
Dearness, J. — (36).
Demaree, Delzie. *7525* (31); *8202* (45); *8239* (13); *8328* (46); *8778* (30); *9430* (13); *9582* (45); *9736* (13); *9931* (45); *10214* (12); *10788* (45); *10809*, *11097* (13); *12827* (36); *13204*, *13252* (48); *13470* (13); *13521* (45); *13729* (46); *13972*, *14104* (13); *14111* (46); *14116* (13); *15278*, *15334*, *15407* (45); *15521* (46); *15736*, *16041*, *16057*, *16298*, *16331*, *18180* (45); *18410*, *18575* (46).
Dewey, L. H. — (13, 26a, 30, 31); *40* (13).
Dick, W. M. — (1).
Dixon, R. A. *335* (29); *376* (30).
Dodge, C. K. — (1, 14); *7* (13); *83* (31); *201* (36).
Dohmen, W. A. *61* (45).
Dowell, P. *6735* (45).
Dreisbach, R. R. —, *6025* (13).
Drouet, F. — (45); *1012*, *1607* (45); *1699* (46).
Drushel, J. A. *9470* (13).
Dukes, W. C. *6* (16a); *11* (48).
Duran, Victor. *3176* (26b); *3205* (31).
Dutton, D. L. — (13).

Eames, E. H. — (1, 13, 45); *45* (1); *54* (14).
Earle, F. S. — (35a); *290* (47); *592* (20).
Earle, F. S., & E. S. Earle. *35* (45); *36* (13); *273* (35a); *279* (7b); *308* (30); *309* (31); *343* (20).
Earle, F. S., & S. M. Tracy. *104*, *381* (20).
Eastwood, Alice. — (35b); *137* (4); *2766* (26a); *2773* (25); *8668* (17).
Eastwood, A., & J. T. Howell. *6292* (28); *6310* (31); *6473* (36); *6616* (32a); *6893* (31).
Eggert, H. — (7b, 20, 30, 35a, 36, 45, 46, 47, 48).
Eggleston, W. W. *1565* (14); *5246* (46); *10274* (35a); *10725* (12); *15951* (43); *15967* (25); *17352* (47); *19370* (42); *20227* (31); *20424* (47).
Ehrenberg, C. — (47).
Ellis, Charlotte C. *335* (9).
Elmer, A. D. E. *200* (35a); *602* (35a, 36).
Emig, W. H. *525* (7b); *527* (30).
Engelmann, Geo. — (36, 46); *1139* (46).
Engelmann, Henry. — (36, 7b).
Epling, C. C. & Hauch. *10008* (35a).
Evans, Walter H. *5* (31).
Evermann, B. W. *1021* (13).
Ewan, J. *4872* (31).

Farwell, Oliver A. — (35a); *235* (35a); *8756* (16a).
Fassett, N. C. *3413* (45); *10258* (36); *10287*, *12574* (45); *18156* (1).
Fassett, N. C., & L. R. Wilson. *10281* (45); *14674* (1).
Fendler, A. *789* (9); *795* (35a); *796* (42); *797*, *798* (47).
Fernald, M. L. — (1, 14, 45); *69* (1); *1980*, *1981* (36); *1983* (14); *2733* (1); *2736* (45); *2737* (14); *2739* (45).
Fernald, M. L., E. B. Bartram & B. Long. *24085* (14).
Fernald, M. L., C. H. Bissell, C. B. Graves, B. Long & D. H. Linder. *21756* (14).
Fernald, M. L., F. K. Butters & H. St. John. *15261* (1).
Fernald, M. L., F. W. Hunnewell & B. Long. *9818* (1).
Fernald, M. L., & H. B. Jackson. *12118* (14).
Fernald, M. L., & B. Long. *5350* (1); *7510* (5); *9747* (16a); *9748* (45); *9817*, *9821*, *12703*, *12704*, *12705*, *12706* (5); *12708*, *12709* (46); *13994* (1); *13996* (14); *13997*, *13998* (45); *17038*, *18684* (1); *18687* (45).
Fernald, M. L., B. Long & A. H. Norton. *13995* (14); *13999* (45).
Fernald, M. L., B. Long & H. St. John. *7719*, *7720*, *7721*, *7722* (1).
Fernald, M. L., B. Long & G. S. Torrey. *9822* (45).
Fernald, M. L., & A. S. Pease. *3407* (36).
Fernald, M. L., & H. St. John. *11114* (1).
Fernow, B. E. — (25).
Ferris, R. S. *8697* (22a); *8699* (39).
Ferris, R. S., & C. D. Duncan, *2698* (12); *3012* (13); *3013* (48); *3129* (15); *3353*, *3422* (7b).
Ferris, R. S., & R. P. Rossbach. *9605* (26b); *9624* (22a).
Ferris, R. S., F. M. Scott & R. Bacigalupi. *3998* (27).
Fink, B. — (45); *451* (13).
Fisher, G. L. *39* (25); *74* (31); *607* (13); *37217* (7a).
Flynn, Nellie F. — (13).
Fogg, J. M., Jr. *2869* (45); *2870* (1); *5934* (13); *7753* (1); *11208* (1).
Forbes, F. F. *2315* (45).
Fosberg, F. R. *S3785* (4); *15754* (14); *15968* (45).
Fowler, J. — (1, 14).
Fredholm, A. *5138* (45); *5429*, *5517* (16a); *6014* (13); *6280* (12); *6348* (16a); *6469* (45).
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Furbish, Kate. — (1, 14, 45).

Gaillardon, Anna. — (35a).
Garber, A. P. — (1, 16b).
Garrett, A. O. *R2708* (35a).
Gates, F. C. *18947* (13).
Gattinger, A. *2485* (46).
Gayle, E. E. *576* (36).
Gentry, H. S. *1119*, *1148* (10); *1608* (8); *5062*, *5395* (44).
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Gilbert, F. A. *493* (45).
Gillespie, J. W. *8415* (26a); *8665* (22a); *8666* (26a).
Gillman, Henry. — (1).
Gleason, H. Allan. *1932* (45).
Gleason, H. A., & F. D. Shobe. *336* (1).
Godfrey, R. K. *6490* (1).
Goldman, E. A. *406* (31); *1162* (22a).
Goodding, L. N. *161* (7b); *257* (36); *519* (35a); *654* (31); *708* (26a); *723*

(31); *759* (4); *798* (14); *2222* (26b); *2282* (32a); *2301* (31).
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Graham, H. L. *31* (13).
Grant, G. B. *427* (31, 45).
Graves, C. B. — (14, 36).
Graves, C. B., B. Long & D. H. Linder. *21754* (1).
Greene, E. L. — (35a, 36, 39); *266* (28).
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Gregg, J. — (45); *215* (23); *457* (33).
Griffith & Schlosse. — (36).
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Griffiths, D., & L. W. Carter. — (36).
Griffiths, David, & J. J. Thornber. *8* (10).
Grimes, E. J. *4433* (13); *4640* (48).
Grinnell, J. — (27).
Gross, C. A. *2498* (1).
Groth, B. H. A. *15* (30); *55* (7a); *131* (19); *208* (13).

Haberer, J. V. *776* (14).
Hale, Josiah. — (29, 48).
Hall, Elihu. — (30, 45, 46); *547* (29); *550* (41a); *559* (19).
Hall, F. W. — (45).
Hall, H. M. & H. P. Chandler. *345* (35a); *7323* (24).
Halsted's American Weeds. *88* (45).
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Harris, Sidney, — (1, 14).
Harrison, G. J. *1938* (22a); *3563* (26b); *5517* (35a); *8142* (8); *8224* (47).
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Hassler, E. *7735* (16a).
Hastings, Geo. T. — (25).
Hatry, O. — (13).
Havard, V. *16* (36).
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Hayes, S. — (18).
Hayward, H. E. *546* (7b); *569* (36).
Headley, F. B. *42* (3c).
Hedgcock, G. G. — (13).
Heermann, A. — (3a).
Heller, A. A. — (13, 29, 31); *668* (13); *669* (45); *670* (14); *1231* (1 & 5); *1463* (30); *1738* (19); *1804* (45); *1918* (48); *1921* (45); *1922* (13); *5802*, *6935*, *9275* (35a); *9674* (31); *11058* (32a); *11118* (35a); *11139* (13); *11140*, *11143* (3a); *11555* (3b); *12524* (35a); *12645* (3a); *13303*, *13815* (35a); *14207* (13); *14300* (7b); *14802* (45).
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Hicks, G. H. — (14).
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Hoar, E. S. — (13).
Hodgdon, A. R. *677* (13).
Hoffmann, Ralph. — (13, 24, 45); *585*, *617* (24).
Hollister, Mabel P. *81* (13).
Holm, Th. — (45).
Holt, E. G. *74* (13).
Holzinger, J. M. — (36).
Holzner, F. X. *1573* (31).
Hoover, R. F. *1277*, *2583*, *3722* (34).
Hope, Thomas. — (1 ,45).
Horner, R. M. *1161* (36).
Hough, Walter. *126* (31).
Houghton. — (1).
House, H. D. *371* (1); *1451* (13); *2583* (45); *2885* (13); *10618* (14); *16990*, *19977* (1); *25024* (36).
Howell, Thomas. *720* (45); *3488* (27); *4973* (24); *6651* (28).
Howell, Joseph & T. J. *787* (45).
Hoyt, Mrs. Capt. — (25).
Huger, A. M. — (13).
Hughes, Mrs. W. R. *22* (12).
Hunnewell, F. W. — (14); *2827* (45); *6876*, *6977* (14); *7365*, *8081* (45).
Hyams, C. F. — (13).

Imler, R. H. *5* (47); *46* (13); *63* (7b); *65* (36).
Ingalls. — (5).

Jaeger, E. C. — (4, 26b).
Jepson, W. L. *577* (3a); *1374* (26b); *1650* (35b); *5964* (26b); *6159* (3a); *6559* (35a); *6879* (27); 7144 (3c); *7762* (35a); *10042* (45); *10112*, *10643* (35a); *11734* (31); *12379* (35a); *12475* (26a); *13924* (35b); *13925*, *13926* (3a); *13934* (35a); *15279a* (3a); *15829* (31); *15964* (35b); *15985* (35a).
Jermy, G. — (7a, 13).
Johnson, Frank W. *1132* (1).
Johnston, I. M. *1050* (26b); *3331*, *3641* (22a); *4136*, *4173* (17); *7028* (18); *7060* (33); *7061*, *7123* (47); *7135* (33); *7183*, *7196* (42); *7211*, *7240* (23); *7387* (47); *7393* (42); *7577* (23); *7673*, *7691* (42); *7694* (23); *7729* (28); *7779* (47); *7780* (43); *7851* (23); *7862* (31); *7874* (9); *7917* (39); *7925* (28); *7928* (42); *7931* (17); *7940* (42); *7954* (43); *7981* (42); *7987* (23); *7991* (31); *7995* (42); *7997* (23).
Jones, G. N. *5285* (36).
Jones, M. E. — (4, 27, 39); *292* (7b); *786* (47); *864* (35a); *1024* (36); *2855* (35a); *3201* (45); *3998* (35a); *4036* (32a); *4097* (17); *4174* (13); *4195* in part (47); *4195* in part (36); *4223* (28); *4247* (12); *4263* (10); *4342* (35a); *4720* (4); *5035*, *5178* (26a); *5467* (35a); *6044* (4); *22604* (8); *22613* (17); *22617*, *24856* (22a); *24859* (12); *24860* (26a); *24862* (10); *24877*, *24878* (26a); *26001* (31); *26013*, *26015*, *28439* (18).
Jones, W. W. *C287* (9); *288* (35a).
Joor, J. F. — (45).
Juett, J. W. — (45).

Kearney, T. H. *156* (45); *1812* (1); *2108* (13).
Kearney, T. H., & R. H. Peebles. — (26a); *9213* (39); *10140* (47); *10145* (43); *10172* (16a); *10215* (39); *10219* (28); *10395* (39); *12060* (25); *12077* (17); *12767* (42).
Kearney, T. H. & E. G. Smith. *9029* (39).
Kellogg, John H. *1845* (45).
Kelly, Junea. — (31).
Kelsey, F. D. — (36).
Kennedy, G. G. — (1, 13, 14); *9*, *10* (14).
Kennedy, P. B. *918* (3c); *1089* (31); *1945* (35a); *7076* (31).
Kennedy, P. B., & L. N. Goodding. *77* (27).
Kildahl, N. J. — (36).
Killian, O. L. *6873* (13).
Killip, E. P. *7343* (1); *31582* (15); *32209* (1).
King, Alice. — (35a).
Kittredge, Elsie M. — (36).
Knight, Elizabeth G., — (1).
Knowlton, C. H. — (1, 14, 36, 45).
Knowlton, F. H. — (13); *159* (35a).
Kramer, Joseph. *152* (7b).
Krause, O. — (45).
Kreager, F. O. *461* (36).
Kuntze, Otto. *23263* (31).

Lakela, Olga. *1563* (36); *2118* (35a).
Lansing, O. E., Jr. *1636* (45); *2502* (48); *2780*, *3339* (13); *3359* (1); *3494*, *4020*, *4028* (13).
Lansing, O. E., Jr. & E. E. Sherff. *5* (45).
Lapham, I. A. — (1).
Larsen, E. L. *425*, *1044* (1).
Laybourn, W. A. *48* (36).
Lea, T. G. — (13).
Ledman, O. S. — (45).
Leeds, B. — (16a).
Leiberg, J. B. *1317* (35a); *3374*, *5573* (31); *5969* (9).
Leibelsperger, W. H. *52* (45).
Leland, George H. — (45).
Lemmon, J. G. *39* (35a); *283* (22a); *454* (43); *469* (10); *2875* (16a); *3112* (17).
Leo, Thomas G. — (46).
Letterman, G. W. — (13).
Lewis, I. F. *164* (5).
Lewton, F. L. — (5, 29).
Lighthipe, L. H. — (13); *427* (5).
Lillis, S. C. — (3a).
Lindheimer, F. — (7a, 19, 45, 48); *104* (32a); *186* (7a); *293*, *294* (41a); *300 Fasc. III* (30); *308* (41a); *429* (19); *508* (41a); *533 Fasc. III* (48); *693* (30); *1148*, *1149* (41a).
Link, E. L. — (45).
Lippincott, C. D. *98* (13).
Lloyd, C. E. — (9); *457* (17); *458* (31); *459* (43); *463* (10).
Lloyd, C. G. *2485* (46).
Lloyd, F. E. — (13, 35a); *209* (42).
Lloyd, F. E., & S. M. Tracy. *207* (5); *208* (29); *213* (12); *214* (5).
Long, B. *4601* (45); *15194*, *17121*, *19622* (13); *26754* (45); *32522* (13); *38946*, *51184*, *51420* (45); *51421* (14).
Long, C. A. E. *74* (1).

Louis-Marie, P. *198* (14).
Lounsberry, C. C. — (13).
Lundell, C. L. *5196* (23).
Lunell, J. — (36); *639* (35a); *692*, *693* (36); *694*, *695*, *696* (35a).

MacBride, J. F. *724*, *1629* (35a).
MacBride, J. F., & E. Payson. *694* (32a).
McCalla, W. C. *287* (1).
McClatchie, J. A. — (26a).
MacDaniels, L. H. — (1).
McDonald, F. E. — (36, 45, 46).
MacDougal, D. T. *122* (22a); *141* (31); *209* (32a); *511* (37).
MacDougal, D. T., & F. Shreve. *48* (22a).
McElwee, A. *691* (13).
MacFadden, Fay A. *12754* (13).
McFarland, F. J. *136* (13).
McKelvey, Susan D. *5038* (26a).
Mackensen, B. — (43); *38* (35a).
Mackenzie, Kenneth K. — (7a, 36, 46, 47); *50* (49); *380*, *2857* (13).
Macoun, John. — (30, 35a); *5897* (30); *5898* (13); *13702b* (35a); *24716* (13); *24720*, *79546*, *87829*, *87830* (36); *87831* (14); *87833*, *87834* (45); *88079* (14); *88081*, *88082*, *88083*, *88084*, *88085*, *88086*, *88087*, *88088* (45); *88089* (1); *88092* (36).
Macoun, John, & Wm. Herriot. *76824* (36).
Maguire, B. *208* (36); *10007* (31).
Maguire, B., & H. L. Blood. *1435* (4); *1436* (31).
Maguire, B. & Ruth R. *11191* (32a).
Maguire, B., & J. D. Redd. *1958* (4).
Maguire, B., & A. G. Richards. *2685* (35a).
Maguire, B., B. L. Richards, Jr. & T. Moeller. *10263*, *10301* (25); *10375* (17); *10421* (31); *10431* (17); *10642* (39); *10834*, *11222* (22a); *11699* (17); *11780* (39); *11788* (31); *11808* (45); *11918* (31); *11982B* (14); *13024* (25); *13068* (17); *16018* (12).
Maguire, B., Ruth R. Maguire & G. Piranian. *12250* (32); *12315* (4).
Maguire, B., A. G. Richards, Ruth Maguire & Ruth Hammond. *5744* (4).
Manning, Sara M. *3019* (13).
Marie-Victorin, F., *1062* (14).
Marie-Victorin & Rolland-Germain. *34052* (14).
Marie-Victorin, F. Rolland-Germain & R. Meilleur. *44015* (36); *44016* (45); *43720* (14).
Mason, H. L. *5506*, *5789* (35b).
Mathias, Mildred E. *653* (32a).
Mead, L. B. — (45).
Mead, S. B. — (45).
Mearns, E. A. *153* (31); *155* (37); *549* (13); *611* (10); *639* (31); *1168* (48); *1192* (30); *2688* (25); *2746* (22a).
Mearns, E. L. *902* (42).
Mell, C. D. *249* (36).
Menzel, Max. — (36).
Merrill, E. D. *1649* (45).
Merrill, G. M. *676* (7a).
Metcalf, F. P. *156* (36).
Metcalfe, O. B. — (14); *722* (31); *1006* (47); *1267* (9); *1292* (43); *1298* (35a).
Meyer, C. V. *230* (26a).
Michels, H. F. *419* (45).
Michener, C. A., & F. T. Bioletti. — (45); *6189* (35a).
Miller, E. S. *119* (13).
Milligan, J. M. — (13).
Mohr, C. — (13, 30, 45); *10* (16a).
Moldenke, C. E. *6632* (13).
Moldenke, H. N. *328* (12); *330* (15); *865* (16b); *1303* (45); *2931* (1); *5301* (5).
Moodie, Marion E. *1199* in part (36); *1199* in part (35).
Mooney, James. — (13).
Moore, A. H. *1948*, *1950*, *4329* (45); *44170* (14).
Morong, T. — (14).
Morss, C. H. — (1).
Morton, Mrs. Annie Fallis. *88* (31).
Moseley, E. L. — (14, 30).
Mowry, H. W. — (26b).
Moyer, L. R. — (13, 36); *205*, *687* (36); *741* (7b); *2319* (13).
Moyle, J. B. *762* (45); *850* (36); *2084* (13); *2333* (7b).
Mueller, C. H. *8077* (32b); *8080* (23); *8081* (41a).
Muenscher, W. C. *5103* (36).
Muir, Robert. *82* (32a); *149* (47).
Mulford, A. Isabel. *943* (9); *1037a* (12).
Munz, P. A. *7577*, *7697*, *13836* (35a).
Munz, P. A., & C. L. Hitchcock. *11032* (27).
Munz, P. A., & W. W. Eggleston. *19622* (25).

Nash, G. V. — (13); *157* (16a); *930*

(12); *1058* (45); *1070* (29); *2448* (5); *2519* (13).
Neally, G. C. — (29); *221* (31); *222* (48); *719* (18).
Nelson, Aven. *2573* (36); *2727* (47); *2743*, *8133* (35a); *11216* (25).
Nelson, A. & R. *1709*, *1955* (25); *2048* (32a).
Nelson, E. W. *6455* (4).
Nevin, J. C. — (35b).
Newlon, L. M. *312* (26a); *584* (31); *699* (22a).
Newman, W. H. — (30).
Nieuwland, J. A. *11736* (45).
Northrop, Alice R. — (1).
Northrop, J. I. — (35a).
Norton, J. B. S. — (13); *467*, *468* (7a); *469* (30); *470* (36); *471* (45); *472* (47); *473* (13).
Nuttall, T. — (1, 7a).
Nye, H. A. — (14).

Ogden, H. V. *7* (45).
O'Neill, Hugh. — (16a); *458* (12).
Oosting, H. J. *34403* (13).
Orcutt, C. R. *765* (18); *2196* (25); *6040* (19); *6074* (45).
Osterhout, Geo. E. *2345* (30); *2369* (36).
Otis, J. P. — (45).
Over, W. H. *6131* (30).
Owens, J. G. — (4).
Ownbey, Marion. *1350* (7b).
Oyster, J. H. — (46); *2469* (30); *7306* (7a).

Painter, J. H. *1027* (13).
Palmer, Ed. — (12, 18, 19, 35b); *15* (31); *20* (11); *42* (31); *43* (47); *68* (8); *83* (17); *92* (31); *142* (17); *183* (11); *186*, *187* (37); *209* (10); *210* (17); *215* (22b); *237* (10); *296* (31); *299* (47); *317* (17); *319* in 1887 (11); *319* in 1904 (47); *320* (42); *321* (39); *370*, *376* (17); *443* (32a); *489* (47); *499* (1); *451* (35b); *501* (42); *509* (31); *532* (42); *548* (23); *567* (47); *627* (22b); *640* (10); *783* (25); *835* (22a); *899* (35a); *1191* (30); *1196* (48); *1197* (23); *1198* (45); *1201* (36); *1202* (45); *1204* (23); *1206* (43); *1207* (31); *1211* (17); *1212* (29); *1517* (17); *2047* (36); *2721* (31).
Palmer, E. J. *1203* (32a); *4261* (13); *6333*, *6379*, *6426* (7a); *8729* (13); *10228* (18); *10285* (7b); *10287* (19); *10310* (20); *10406* (7a); *10984a* (18); *12096* (48); *12832* (7a); *14542* (7b); *33618* (18); *33786* (31); *34199* (17); *34207* (26c); *41860* (36); *41887* (7b).
Pammel, L. H. — (35a); *190* (36); *192* (30); *193*, *620* (36).
Pammel, L. H., & C. R. Ball. *191* (36).
Pammel, L. H., & R. E. Blackwood. *3911* (36).
Pammel, L. H. & Violet. *34* (45).
Parish, S. B. *8301* (28); *8302*, *8305* (37); *9608* (26a); *9882*, *10138*, *10190*, *10217* (27); *10375* (3c).
Parish, S. B. & W. F. *672* (35a); *1370* (3c); *1384* (39).
Parker, C. F. — (30).
Parlin, J. C. — (36); *52* (14).
Parry, C. C., & Ed. Palmer. *817½* (47).
Parry, C. C., J. M. Bigelow, Charles Wright & A. Schott. — (18, 31).
Payson, E. B. *119* (32a); *510* (36); *2320* (32a).
Pease, A. S. *2716* (1); *4704* (45); *9858* (1); *11616*, *14104* (45); *14469* (14); *16591*, *18138* (36); *19128*, *23971*, *25316*, *25345* (14); *26455* (16b).
Pease, A. S., & R. C. Bean. *23435* (36).
Pease, A. S., & M. Hopkins. *24006* (14).
Peck, M. E. *9562*, *13656* (35a); *18612* (36).
Peebles, R. H. *5000* (28); *5834* (37); *6420* (26a); *6493* (17); *9599* (4); *10595* (37).
Peebles, R. H., & H. J. Fulton. *11446* (17).
Peebles, R. H., & G. J. Harrison. *4692* (12); *5021* (22a).
Peebles, R. H., G. J. Harrison & T. H. Kearney. *83* (37); *224* (12); *2461* (26a); *2773* (10); *3685* (39); 4576 (28); *4589* (9); *4590* (12); *4653* (16a); *4909* (22a); *4976* (28); *5564* (47); *5565* (35a); *5628* (22a).
Peebles, R. H., & T. H. Kearney. *264* (48); *10836* (25); *10939* (22a).
Peebles, R. H., & F. H. Loomis. *6755* (39).
Penard, E. *301* (7b).
Pendleton, R. L. *1398* (35a).
Pennell, F. W. *2214* (1); *4042* (13); *7459* (45); *8282* (13); *14815* (28); *17570* (23); *18991*, *19477* (31); *19730* (8); *20214* (22a).
Perkins, C. E. — (14)
Perry, R. C. — (13)

Peirson, F. W. *4256* (39); *12599* (36).
Peterson, Alfred. — (35a, 45).
Petersen, N. F. — (47).
Phelps, O. P. *635* (14); *636* (45).
Pieters, A. J. — (13, 45).
Pilsbry, H. A. — (39, 47).
Pitard, C. J. — (1).
Plank, E. N. — (18, 30, 46, 48).
Plateau, E. *5447* (41a).
Plitt, C. C. *857* (1).
Pollard, C. L. — (13); *92* (7b); *648* (13); *1155* (45).
Pollard, C. L., G. N. Collins & E. L. Morris. *126* (15).
Pollock, W. M. — (13).
Porter, T. C. — (1, 13).
Pretz, H. W. *4842* (45); *11116* (13).
Pringle, C. G. — (3a, 8, 9, 10, 12, 17, 26a, 31, 37, 39); *80* (47); *81*, *286* (35a); *326* (43); *327* (47); *699* (17); *799* (42); *999* (9); *2074*, *3747* (49); *8278* (18).
Purpus, C. A. *4512* (33); *4599* (39); *5473* (24); *6187* (3c); *6437* (28).

Ramaley, F. & J. Ewan. *16325* (7b).
Rand, Ed. L. — (45).
Randolph, Fannie R. *135* (16b).
Randolph, L. F. & Fannie R. *827*, *989* (45).
Rattan, Volney. *57* (3b).
Raup, H. M., & C. A. Weatherby. *565* (14).
Ravenel, H. W. — (13, 29, 45).
Reed, E. L. *3005* (30).
Reed, F. M. — (25)
Rehder, A. — (36).
Reverchon, J. — (20, 36, 48); *Curtiss North Amer. Pl. 2478** (32a); *Curtiss North Amer. Pl. 2498** (13); *135* (18); *765* (36); *1345*, *1353* (18); *1355* (20); *3787* (30); *3789* (36); *3797*, *3799* (7b).
Rich, W. P. — (1).
Richardson. — (36).
Rickett. *1134* (46).
Ricksecker, Alfred E. — (13); *81* (36).
Riddell & Carpenter. — (30).
Ridgway, R. *3133* (45); *3260* (13).
Riehl. *472* (36).
Roberts, T. S. — (45).
Robbins. *10* (48).
Robinson, B. L. *97* (14); *229* (13); *237* (48); *489*, *539* (45); *578*, *616*, *851* (14).
Robinson, C. B. *187* (1).
Rockwell, Ethel. *300* (26a).
Rollins, R. C. *1699* (32a); *1874* (35a); *1876* (47).
Rollins, R. C., & T. S. Chambers. *2761* (42); *2770* (26c).
Rose, J. N. *16696* (39).
Rose, J. N., & Wm. R. Fitch. *17011* (30); *17086* (47); *17099* (7b); *17620* (36); *17638*, *17699* (9).
Rose, J. N., J. H. Painter & J. S. Rose. *9611* (35a).
Rose, J. N., & P. G. Russell. *24111* (41a).
Rose, J. N., P. C. Standley & P. G. Russell. *12728* (16a); *12935* (31); *13276* (22a); *13541* (37); *14934*, *15074* (31).
Rose, L. N. *34521* (25).
Rosendahl, C. O. *2332* (45); *4177* (7b).
Rotchslein, David. — (45).
Rothrock, J. T. — (45); *339* (4); *672* (14).
Runyon, Robert. *1495* (13); *2541* (49).
Rusby, H. H. — (4); *317* (17); *378½* (30); *380* (31); *822* (17); *827* (4).
Ruth, Albert. *686* (29); *2498* (13).
Rydberg, P. A. — (7b); *77*, *197* (36); *353* (7b); *355* (36); *356* (35a); *992* (36); *1372* (7b); *1373*, *1742* (36); *8223* (13).
Rydberg, P. A., & A. O. Garrett. *8382* (32a); *9896* (28); *9897* (36)
Rydberg, P. A., & R. Imler. *662* (7); *747*, *919* (7b); *944* (20); *1065*, *1153* (47); *1193* (30); *1244* (47); *1252* (36).

Safford, W. E. *233* (1); *1247* (23).
St. John, H. *787*, *2787*, *2788* (1).
Sandberg, J. H. — (13); *888* (36).
Sandberg, J. H., J. B. Leiberg. *472* (36).
Sanford, S. N. F. *10384* (1).
Schaffner, J. G. *855* (43).
Schellenger, E. E. *78* (31).
Schoenfeldt, L. *2896* (31).
Schott, A. — (11, 39).
Schuette, J. H. — (36).
Schulz, E. D. *301* (35a); *720* (13).
Scully, F. J. *284* (45).
Seymour, F. C. *2009* (14).
Shantz, H. L. — (47).
Shaw, C. H. *1146* (36).
Shear, C. L. — (13); *119* (47); *126* (7b); *176* (30); *183* (36).
Sheldon, Chas. S. — (7a, 36).
Sheldon, E. P. *917*, *1285* (35a); *1557*

(36); *1560* (45); *1658, 5966, 8114* (36); *8630, S11309* (35a).
Sheldon, J. L. *514* (45).
Sherff, Earle E. — (1).
Short, C. W. — (1).
Shreve, F. — (4); *5154* (25); *5354* (26a); *6320, 6375* (8); *7096* (17); *7922* (4); *8820* (42).
Skehan, J. *51* (47); *71* (35a); *118* (9).
Simpson, J. H. — (16a); *310, 388* (15); *505* (16b).
Singer, J. W. *353* (13).
Singleton, J. R. *213* (13).
Small, J. K. *2113* (5); *4036* (15).
Small, J. K., & J. J. Carter. *644, 3209* (15).
Small, J. K., J. J. Carter & G. K. Small. *3627* (15).
Small, J. K., & C. A. Mosier. *5699* (15).
Small, J. K., C. A. Mosier & G. K. Small. *6800* (12).
Small, J. K. & E. W. *5869* (5).
Small, J. K. & G. K. *4556, 4580* (45); *4619* (15); *4694* (16b).
Small, J. K., J. W. Small & J. B. DeWinkeler. *10568* (48); *11470* (29).
Small, J. K., & E. T. Wherry. *12047* (20).
Smart. — (11).
Smith, B. H. *81* (35a).
Smith, H. H. *5979* (45).
Smith, J. D. — (13).
Smith, L. B. *2496* (45).
Smith, Uselma C. — (13).
Smyth, B. B. *45* (7b).
Somes, M. P. *3569* (13); *3841* (30).
Spencer, Mary F. — (26b, 35b); *552* (31); *964* (35a); *970* (35b); *970* (45).
Sperry, Omer E. *T243* (13); *T244* (12); *449* (23); *450* (12); *1358* (26c); *1464* (28).
Stabler, L. M. — (1).
Standley, Jeannette P. *307* (12).
Standley, P. C. *4939* (47); *5054* (35a); *7053* (42); *7371* (36); *7499* (35a); *12656* (12); *40287* (18); *40295* (31); *40362* (7b); *40397* (42).
Standley, P. C., & H. C. Bollman. *12243* (13).
Stanfield, S. W. — (7a, 19, 29, 41a).
Stearns, Elmer. — (4); *245* (39).
Steele, E. S. & Mrs. *37* (13).
Steele, E. S., & H. S. Pratt. — (25).
Stephenson, Mary R. *191* (30).
Stevens, G. W. *308, 350* (32a); *622* (7b); *833* (48); *834* (30); *835* (47); *1054* (45); *1055* (36); *1105* (31); *1334.1* (45); *1602* (47); *1603* (45); *1604* (30); *1640* (48); *1641, 1779* (36); *1798* (13); *1863* (30); *1864* (48); *1917½* (13); *2170* (45); *2182* (46); *2307* (45); *2309* (46); *2344* (7a); *2584* (45); *2960* (7a); *3277* (36).
Stevens, O. A. *290, 384* (36).
Stevens, W. C. — (13, 30).
Steyermark, J. A. *506* (45); *8843* (46); *13925* (45); *13931, 14085, 15910* (46); *15972* (7a); *19543* (45); *19642* (7a); *19716, 19867, 20281* (46); *24316* (30); *24317* (46).
Stone, Mrs. Frederick M. *373* (31).
Stone, Witmer. — (45, 13); *1077A* (45).
Stratton, R. *206* (7a); *441* (20); *448* (35a); *459* (47); *656* (7b).
Stuart, Robbie. *147* (7b).
Sudworth, G. B. — (36).
Suksdorf, W. N. *86* (36); *489* (36); *12327* (13).
Sullivant, W. S. — (1).
Svenson, H. K. *137* (45); *139* (13).
Swingle, D. B. — (35a).

Taylor, B. C. *784, 1568* (36).
Templeton, B. *1632* (39).
Thackery, F. A. *83* (25).
Tharp, B. C. *881, 1180, 1416* (30); *2854* (7a); *3557* (42); *4427* (31); *6013* (19).
Thompson, C. H. *2* (36); *60* (7b).
Thompson, J. W. *3749* (36); *11122, 11891* (35a).
Thornber, J. J. — (13, 36, 45, 47); *47* (42); *136* (10); *209* (12); *341* (28); *342* (37); *7111, 9055* (47); *9141* (11).
Thurber, Geo. — (18, 20); *98* (31); *731* (47); *749* (31); *963* (43).
Thuron, F. W. *4* (30).
Tidestrom, I. *802* (22a); *6902* (13); *7028* (12); *7460* (13).
Tolstead, W. L. — (7b); *621, 806* (36).
Torrey, J. *478* (35a).
Toumey, J. W. — (12, 31, 48); *260* (22a); *261* (42); *263* (26a); *266* (35a).
Townsend, C. H., & C. M. Barber. *284* (9).
Tracy, Joseph P. *6555* (35a).
Tracy, S. M. *154* (32a); *437* (31); *2913* (45); *3125* (30); *4710* (29); *4717* (5); *6370* (29); *6376* (5);

7429, *7432* (13); *7435* (30); *7436* (45); *7842* (13); *7844* (30); *7852* (32a); *7858* (45, 48); *7861* (36); *8119* (13); *8121* (7b); *8124* (7a); *8127* (30); *8167* (48); *8168* (7a); *8169* (47); *8170* (30); *8477a* (45); *8953*, *8987* (17); *9018* (13); *9115* (16b); *9123*, *9124* (48); *9125* (31); *9127* (15).
Tracy, S. M., & Earle. *2882* (5).
Tracy & Lloyd. *209* (45).
Train, Percy. *676* (31); *1875* (4).
Trelease, William. — (36, 45); *873*, *874*, *877*, *878*, *880*, *1178* (13).
Trueman, H. — (1).
Turner, G. H. *66* (36).
Tweedy, Frank. *258* (19); *268* (31); *368* (36); *5057* (35a); *5058* (36).

Umbach, L. M. —, *1917* (1); *2313* (36); *2315* (45).
Underwood, L. M., & A. D. Selby. *156* (35a); *240* (36).

Vasey, Geo. R. — (1, 13, 20, 26b, 36); *574* (31); *576* (35b); *577* (3a).
Visher, S. S. *2022* (36); *2359* (35a); *4103* (13).

Wadmond, S. C. *2943* (45).
Waldron, C. H. — (45).
Walker, Harriet A. *910* (35a).
Wallace, E. J. — (7b, 30, 36); *121* (36).
Wann, F. B. *27* (31).
Ward, L. F. — (13, 30).
Ware, Robt. A. *4138* (45).
Ware, R. A., R. W. Woodward & E. B. Harger. — (45).
Warner, S. R. — (13).
Warnock, B. H. *T95* (26c); *T202* (41a); *C506* (26c); *T589* (47); *C646* (41a); *657* (39); *665* (31); *985* (26c); *998* (21).
Watson, S. *1077* (3c).
Waugh, F. A. *381*, *397* (13).
Weatherby, C. A. *5104* (45).
Weatherby, C. A. & U. F. *5700* (1).
Weatherby, C. A., & J. F. Collins. — (1).
Webb, R. J. *469* (45); *1436* (1).
Webber, H. J. *2* (7b); *7* (36); *11* (7b); *26* (12).
Werner, W. C. — (14, 46).
Wheeler, C. F. — (13, 14).
Wheeler, [G. M.?] — (36).
Wheeler, H. E. *140* (45); *1207* (13); *1209* (48).
Wheeler, J. A. — (13).
Wheeler, L. C. *1330*, *3652* (45); *4041* (3b).
Wheeler, W. A. *336* (13); *430* (45); *434* (36).
Wheeler, W. H. *296* (45).
Whetzel, H. M. *12388* (14).
White, D. *296* (1).
White, Mark. — (7, 36).
White, Stephen. *1145* (45).
Whitehouse, Eula. *502* (20).
Wiegand, K. M. — (13); *755*, *8408* (14).
Wiegand, K. M., B. Maguire, B. L. Richards, Jr. & T. Moeller. *10761* (39); *10778* (17).
Wiegand, K. M., & W. E. Manning. *1801* (29); *1814*, *1816* (45); *1817* (12).
Wiegand, K. M., & G. B. Upton. *3748* (25).
Wiggins, I. L. *4357* (25); *4364* (22a); *5915* (25); *5967* (22a); *6124* (10); *6125*, *6311* (22a).
Wiggins, I. L., & D. Demaree. *5020* (35a).
Wiggins, I. L., & J. W. Gillespie. *4141* (31).
Wilcox, T. E. *320* (12); *328* (35a).
Wilkinson, E. H. *52* (48); *56* (13).
Williams, E. F. — (1).
Williams, R. S. *160* (30).
Williams, T. A. — (7b, 13, 30, 35a).
Williamson, C. S. — (29, 30, 1); *2418* (1).
Williamson, Mrs. W. J. *242* (13).
Wilson, Guy. *27* (13).
Wislizenus, A. *464* (7b).
Wislizenus, F. *377* (13).
Wolf, C. B. *2300* (26a); 2321 (35a).
Wolf, J. — (30).
Woodward, R. W. — (13, 14, 1, 45).
Wooton, E. O. — (9, 12, 13, 14, 26a, 28, 30, 39, 42, 43); *75* (31); *346* (9); *349* (4); *425*, *608* (35a); *609* (12).
Wooton, E. O., & P. C. Standley. — (9); *3273* (47); *3617* (31).
Wright, C. — (7a, 18, 41a, 41b); *186* (17); *652*, *657* (18); *658* (42); *1739* (18); *1828* (19); *1829* (10); *1832* (11); *1839*, *1840* (18); *1841* (20); *1842* (16a); *1842* (13); *1843*, *1844* (42); *1845* (43); *1848* (32a, 22a); *1849* (17); *1853* (36); *1854* (28); *1855* (36).
Wurzlow, E. C. — (48, 45, 46, 16b); *19* (13).
Wyatt, S., & M. Franklin. — (1).
Wynd, F. L., & C. H. Mueller. *37* (23); *77* (47); *243* (18); *274* (31).

Young, Mary S. *139* (26c); *50* (41a).
Young, H. A. — (45).
Zuck, Myrtle. — (28, 36).
Zundel, G. L. *242* (36).

Explanation of Plates 654–668

Note: In plates 654–655A, 656–663 and 667 the various structures are arranged under the following uniform system of numbers for each species: 1, habit of branch; 2, cyathium with mature capsule; 3, capsule viewed from the stylar end; 4, glands, and appendages if present, viewed from above; 5, styles; 6, basal view of seed, raphe up; 7, lateral view of seed, micropyle up, raphe on left; 8, "radial" view of seed with raphe toward the observer and micropyle up; 9, leaf; 10, node showing stipules.

Plate 654. A. Euphorbia polygonifolia L., from Massachusetts, *G. G. Kennedy*, Aug. 24, 1904 (G). B. E. ammannioides HBK., from Florida, *J. A. Harris C17205* (G). C. E. Geyeri Engelm., from Illinois, *Gleason*, Aug. 18, 1904 (G). D. E. Parryi Engelm., from Utah, *Maguire & Redd 1958* (I).

Plate 655. A. Euphorbia thymifolia L., from Tamaulipas, Mexico, *Ed. Palmer 572* in 1910 (M 778646). Figures in same order as in first ten plates. B. 1, diagram of type of habit usual in Euphorbia subgenus Esula and sometimes occurring in subgenus Agaloma; 2, diagram of apparent habit of growth of E. gracillima and revoluta; 3, diagram of branch of E. maculata; 4, diagram of species such as E. supina; 5, diagram of cross-section of cyathium cut just below the intervals between the glands and the lobes: a, interval of reduced 5th gland; b, silhouette of gland to show its position; c, silhouette of appendage; 4, pedicels of staminate flowers (androphores); e, pedicel of pistillate flower (gynophore); f, bracteoles; g, involucre; 6, diagram of involucre spread out flat: a, 5th gland; b, sinus; c, gland; d, lobe; 7, diagrammatic cross-section of capsule; a, carpel; b, testa.

Plate 656. A. Euphorbia vermiculata Raf., from New York, *Stewart H. Burnham*, Aug. 3, 1914 (G). B. E. maculata L., from Indiana, *Deam 32083* (G). C. E. glomerifera (Millsp.) L. C. Wheeler, from British Honduras, *Lundell 1841* (G). D. E. hyssopifolia L., from Arizona, *M. E. Jones 28751* (M 1013009).

Plate 657. A. Euphorbia hirta L. var. typica, from Tamaulipas, Mexico, *Ed. Palmer 6* in 1910 (G). B. E. capitellata Engelm., from Arizona, *Maguire, Richards & Moeller 11699* (G). C. E. serpyllifolia Pers. var. genuina, fig. 1 from "authentic specimen", apparently from herb. Thibaut (M 200327); figs. 2–9 from New Mexico, *A. Nelson 11638* (G). D. E. polycarpa Benth. var. typica, from California, *G. C. Deane*, Apr. 30, 1883 (G.).

Plate 658. A. Euphorbia cordifolia Ell., from Texas, *Ed. Palmer 1212* in 1879 (G). B. E. Parishii Greene, from California, *Parish 10217* (J). C. E. micromera Boiss., from Arizona, *Peebles, Harrison & Kearney 4576* (US). D. E. serrula Engelm., from Coahuila, *I. M. Johnson 7673* (G).

Plate 659. A. Euphorbia angusta Engelm., from Texas, *Cory 3188* (G). B. E. acuta Engelm., from Texas, *Cory 508* (G). C. E. lata Engelm., from Texas, *Cory 1919* (G). D. E. villifera Scheele var. typica (vesture omitted), from Texas, *Cory 7006* (G).

Plate 660. A. Euphorbia theriaca sp. nov., from the type from Texas, *Mueller 8080* (G). B. E. glyptosperma Engelm., from Nebraska, *Tolstead 621* (G). C. E. Chamaesyce L., from Texas, *Cory 6763* (G). D. E. Abramsiana L. C. Wheeler, from the type collection from California, *Abrams 4097*, fig. 1 (G), figs. 2–9 (Ph).

Plate 661. A. Euphorbia setiloba Engelm., from Arizona, *M. E. Jones 24880* (G). B. E. arizonica Engelm., from Arizona, *Maguire, Richards & Moeller 11780* (G). C. E. serpens HBK., from Texas, *Cory 25547* (G). D. E. albomarginata T. & G., from Nevada, *Eastwood & Howell 6310* (G.)

Plate 662. A. Euphorbia laredana Millsp., from Texas, *Pringle 3747* (G). B. E. stictospora Engelm. from Nebraska, *Bates*, July 22, 1904 (G). C. E. humistrata Engelm. from Kentucky, *Eggleston 5246* (M 149855). D. E. supina Raf. from New York, *Phelps 636* (G).

Plate 663. A. Euphorbia melanadenia Torr., from California, *M. E. Jones*, Mar. 16, 1926 (G). B. E. cinerascens Engelm., from Texas, *Moore & Steyermark 3266* (G). C. E. vallis-mortae (Millsp.) Howell, from California, *Purpus 5473* (G). D. E. indivisa (Engelm.) Tidestrom, from Arizona, *Harrison & Kearney 6028* (G).

Plate 664. A. Euphorbia Golondrina L. C. Wheeler, from photograph and fragments of the type from Texas, *Warnock 998* (G): 1, branch; 2, cyathium with mature capsule; 3, glands and appendages from above; 4, capsule viewed from stylar end; 5, basal view of seed, raphe up; 6, lateral view of seed, micropyle up, raphe on right; 7, raphal side of seed, micropyle up; 8, young pistillate flower. B. E. Hooveri L. C. Wheeler, from California, *Hoover 2583* (G): 1, branch; 2, cyathium with mature capsule; 3, cyathium viewed from above, capsule omitted; 4, capsule viewed from stylar end; 5, seed, basal view, raphe up; 6, lateral view of seed, raphe on right, micropyle up; 7, raphal view of seed, micropyle up; 8, node showing stipules and leaf; 9, involucre opened, inside view. C. E. pediculifera Engelm. figs. 1–9 var. typica, from Arizona, *Maguire, Richards & Moeller 10834* (G); figs. 10–11 var. linearifolia S. Wats., from the type, Sonora, Mexico, *Ed. Palmer 215* in 1887 (G): 1, branch; 2, cyathium with mature capsule; 3, glands and appendages from above; 4, capsule viewed from stylar end; 5, seed, basal view, raphe up; 6, lateral view of seed, raphe on right, micropyle up; 7, raphal view of seed, micropyle up; 8, styles; 9, leaf; 10, branch; 11, leaf.

Plate 665. A. Euphorbia ocellata D. & H. var. typica, from California, fig. 1 from "C. E. J." (G); figs. 2–7 from *J. T. Howell 8168* (G): 1, branch with typical large leaves; 2, branch with narrow late-season (Nov.) leaves; 3, capsule, stylar view; 4, glands from above; 5, cyathium with mature capsule; 6, seed, raphal view, micropyle up; 7, seed, lateral view, raphe on left, micropyle up; 8, diagram of cross-section of seed. B. E. ocellata D. & H. var. Rattanii (S. Wats.) L. C. Wheeler, from the type from California, *Rattan 57* (G): 1, branch; 2, glands and appendages from above. C. E. ocellata D. & H. var. arenicola (Parish) Jepson, from isotype from California, *Parish 1370* (G): 1, branch. D. E. platysperma Engelm., from type collection from Arizona, *Ed. Palmer* in 1869, figs. 1–4 (US 58628), figs. 5–7 (G): 1, branch; 2, cyathium with half-grown capsule; 3, cyathium from above, capsule omitted; 4, styles; 5, diagram of cross-section of seed; 6, seed, lateral view, raphe on left, micropyle up; 7, seed, raphal view, micropyle up.

E. E. incerta *T. S. Brandegee*, from Revillagigedo Islands, Baja California, Mexico, *Anthony 399* (G): 1, branch; 2, styles; 3, capsule viewed from stylar end; 4, cyathium with mature capsule; 5, cyathium from above, capsule omitted; 6, seed, lateral view, raphe on left, micropyle up; 7, seed, raphal view, micropyle up; 8, diagram of cross-section of seed. (This extra-limital species included because of its close relation to *E. ammannioides* and *polygonifolia*).

Plate 666. A. Euphorbia astyla Engelm., from Texas, *Cory 1960* (G): 1, branch; 2, node with leaves; 3, young pistillate flower; 4, cyathium with mature capsule; 5, glands and appendages from above; 6, diagram of cross-section of seed, raphe up; 7, seed, lateral view, raphe on left, micropyle up; 8, raphal view of seed, micropyle up; 9, capsule, stylar view showing entire styles. B. E. missurica Raf. var. typica, from Missouri, *Bush 737A* (G): figures in standard order as in first ten plates. C. E. Fendleri T. & G. var. typica, figs. 1–7 from Texas, *Cory 8729* (G); fig. 8 from Nevada, *Clokey 7578* (G); fig. 9 from Nevada, *Clokey 7183* (G): 1, branch; 2, glands and appendages from above; 3, cyathium with mature capsule; 4, seed, lateral view, raphe on left, micropyle up; 5, raphal view of seed, micropyle up; 6, diagram of cross section of seed, raphe down; 7, stylar view of capsule; 8, node with whorl of 3 leaves; 9, node with whorl of 5 leaves. D. E. Fendleri T. & G. var. chaetocalyx Boiss., from Texas, *Cory 1964* (G): 1, branch; 2, glands and appendages from above. E. E. Fendleri T. & G. var. triligulata L. C. Wheeler, from Texas, *Moore & Steyermark 3444* (G): 1, branch; 2, glands and appendages from above.

Plate 667. A. Euphorbia gracillima S. Wats., from Arizona, *Harrison 8142* (US 1530966). B. E. revoluta Engelm., from Chihuahua, *I. M. Johnston 7874* (G). C. E. florida Engelm., from Arizona, *Harrison & Kearney 8943* (US 1566544). D. E. trachysperma Engelm., figs. 1–4 from Arizona, *Ed. Palmer 20* in 1869 (US 58604); figs. 6–8 from Arizona, *Wright 1832* (G).

Plate 668. A. Euphorbia Chamaesyce L. Photograph of type from Jamaica, *P. Browne* (Linnaean Herb.). B. E. maculata L. Photograph of type, source and collector unknown (Linnaean Herb.)—Photographs courtesy of Section of Photography, Field Museum of Natural History.

Phragmites communis versus P. maximus.—In recent years several botanists have followed Chiovenda in Nuovo Giorn. Bot. Ital. n. s. xxvi. 80, No. 110, No. 167 (1919), in taking up for the smooth- and nonciliate-leaved *Phragmites communis* Trin. the name *P. maximus* (Forsk.) Chiov. It is most difficult to believe that those who have done so can have taken the few minutes of time to look up Forskål's original diagnosis, which follows:

> 86. Arundo maxima: *foliis margine ciliatis, basi albis, hirsutie ciliatis, striatis, planis, totis viridibus.*
>
> Folia juniora tota margine ciliato-scabra; quae scabrities aetate evanescit. Basi vero omnia folia semper margine hirsuto-ciliata.

—Forskål, Fl. Aegyptiaco-Arabica, 24 (1775).

A superficial examination of *Phragmites communis*, whether of Eurasia, Africa or America, is sufficient to show its lack of ciliate-scabrous leaf-margin and of persistent (or any) hirsute ciliation at base of the blade. On this account alone the identification with it of Forskål's *Arundo maxima* is wholly unconvincing. It is further unconvincing since Forskål left no specimen to stand for *A. maxima;* Christensen, in his critical *Index to Pehr Forsskål: Flora aegyptiaco-arabica 1775, with a Revision of Herbarium Forsskålii,*[1] stating that of the species of *Arundo* enumerated by Forskål this is wanting in the herbarium, while the plant which Forskål misidentified as *Arundo Donax* L., "*Foliis . . . basi glabris* . . . non ciliata margine", is ("at least the plants from Egypt") really one of the varieties of *Phragmites communis.* Furthermore, the distinguished English authority on grasses, C. E. Hubbard, writes as follows: "The basis of this name, *Arundo maxima,* Forsk. is . . . a very dubious species, insufficiently diagnosed, and unrepresented in Forsskal's Herbarium . . . According to Forsskal, it is distinct from *Arundo Donax* (Forsk. l. c. 23), but the specimen of the latter in Forsskal's Herbarium is of the tall race of *Phragmites communis.*—C. E. Hubbard in A. W. Hill, Fl. Trop. Afr. X[1]. 155 (1937).

There is complete justification for dropping for the clearly typified and correct *Phragmites communis* the vague and obviously misapplied name *P. maximus.*—M. L. Fernald.

Two Varieties of Dicliptera brachiata.—

Dicliptera brachiata (Pursh) Spreng., var. **glandulosa** (Scheele), stat. nov. *D. glandulosa* Scheele in Linnaea, xxi. 765 (1848).

Dicliptera brachiata, based upon *Justicia brachiata* Pursh, Fl. Am. Sept. i. 13 (1814), came originally from islands of Roanoke River, North Carolina. It is, therefore, the characteristic plant of the Coastal Plain, from Florida to Louisiana, north to southeastern Virginia, southern Indiana, Missouri and Kansas, with stem minutely puberulent or pilose above, long-petioled acuminate thin leaves and glabrous to minutely pilose bracts. Var. *glandulosa,* the plant of Texas, south to Vera Cruz, Mexico, has

[1] Christensen in Dansk Bot. Arkiv iv. no. 3 (1922).

the stem spreading-villous or -hirsute, the bracts somewhat so and the leaves usually minutely strigose-puberulent. The specific name given by Scheele to the Lindheimer material from New Braunfels is not appropriate, since he evidently mistook the minute puberulence for glands. Another Texan extreme of the species needs designation. This is a grayish-green plant with cinereous-puberulent to glabrescent stems and branches and small, obtuse and minutely strigose-puberulent leaves and glabrous to sparsely puberulent bracts. I am calling it

D. brachiata, var. **Ruthii,** var. nov., caulibus cinereo-puberulis; foliis crassis cinereo-puberulis, obtusis; bracteis glabrescentibus. Type: grassy open woods, near Fort Worth, Texas, August 12, 1912, *A. Ruth*, no. 230 (in Herb. Gray).

—M. L. Fernald.

Varieties of Acnida altissima.—

Acnida altissima (Riddell) Riddell ex Moq., var. **subnuda** (S. Wats.) comb. nov. *A. tuberculata*, var. *subnuda* S. Wats. in Gray, Man. ed. 6: 429 (1889). *A. subnuda* (S. Wats.) Standley in N. Am. Fl. xxi^2. 122 (1917).

A. altissima, var. **prostrata** (Uline & Bray), comb. nov. *A. tamariscina*, var. *prostrata* Uline & Bray in Bot. Gaz. xx. 158 (1895). *A. tuberculata*, var. *prostrata* (Uline & Bray) Robinson in Rhodora, x. 32 (1908).

Acnida tuberculata Moq. in DC. Prodr. xiii^2. 277 (1849) was clearly antedated by *Amaranthus altissimus* and *A. miamiensis* Riddell Syn. Fl. W. States, 41 (1835), called *Acnida altissima* and ascribed to Riddell by Moquin, l. c. 278 and correctly taken up by Standley, l. c., with *Amaranthus miamiensis* as a synonym.—M. L. Fernald.

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CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. CXXXVIII

A MONOGRAPHIC STUDY OF ARABIS IN WESTERN NORTH AMERICA

Reed C. Rollins

In *Arabis*, one of the larger genera of the *Cruciferae*, the excessive variability of certain species and the lack of sharply defined diagnostic characters throughout have given it a reputation of being exceedingly complex. The speciation is especially complicated in the Cordilleran region of western North America which is one of the principal centers of distribution for the genus. Elsewhere, *Arabis* is represented mostly in the north-temperate regions of the world with special areas of species-concentration in Europe and Asia. An inadequate appreciation of the importance of *Arabis* in North America is evident in all general systematic treatments of the *Cruciferae*. Even in the late pretentious work of O. E. Schulz,[1] the American species were not sufficiently considered in setting up the sixteen sectional divisions. As a result, many of our species are not properly referable to any section.

Perhaps one reason why American species have been largely ignored by the creators of world-wide systems of plant-classification is the lack of an inclusive, detailed study of *Arabis* in which the species and their relationships have been carefully and accurately evaluated. Recently, Hopkins[2] has partly met

[1] Engler & Harms, Pflanzenf. **17b**: 542–547 (1936).

[2] Rhodora **39**: 63–98, 106–148, 155–186 (1937).

the need by giving us a treatment covering eastern and central North America, but the larger task of dealing with the species of the western portion of the North American Continent has not been accomplished. The central object of the present study has been the preparation of a systematic account of *Arabis* to fill this gap, but natural variation and the phylogenetic relationships of the species have also received attention.

Unlike many genera of plants with endless modifications of flower-parts, the flowers of *Arabis* are monotonously uniform. Even the fruits and foliage are alike in some species so that in many instances trivial structures must be elevated to a position of prominence in treating the species and their relationships. Fortunately there are a number of clearly discrete species in *Arabis* which have been available as points of reference in their respective circles of affinity. These species are guide-posts to limits of variation and definitive characters and afford a general basis for interpreting species of a less clearly defined nature. The practice of constantly referring to natural, clearly defined species for aid in clarifying those of some obscurity has been such a standard procedure in the present investigation that it is expedient to list some of the species used. These are *A. blepharophylla, A. cobrensis, A. Crandallii, A. crucisetosa, A. Cusickii, A. dispar, A. furcata, A. glaucovalvula, A. Koehleri, A. Parishii, A. perennans, A. platysperma, A. rectissima, A. Shockleyi* and *A. suffrutescens.*

The taxonomic history of *Arabis* has been carefully worked out and presented by Hopkins.[1] A further discussion of the subject is unnecessary. Except for one species, *A. petiolaris,* not included by Hopkins, this study is concerned with the native species of *Arabis* occurring west of the one hundredth meridian in North America. It is expected that the present paper will be used in conjunction with that of Hopkins so that wherever possible duplication of his work has been avoided.

The present work cannot be considered to be final. *Arabis* is too complex for that. However, as much data and experience as it has been possible to assemble over a period of half-a-dozen years have been directed toward a solution of the problems involved. Some species are inadequately known because the re-

[1] Op. cit. pp. 63–66.

gions inhabited by them have not been botanically explored. Others should be studied genetically and cytologically to elucidate certain problems concerning them. Still others should be cultivated in various ecological situations in order to test their presumed plasticity. These methods of approach are beyond the possible scope of this investigation, but it is hoped they will eventually be utilized. Eighteen of the fifty-three species included in the present work have been grown continuously for two or three years. All flowered except *A. hirsuta* and *A. glabra* which grew vigorously for three years without producing flowering stems. The plant-cultures were grown from seed collected in the wild and have been used for observations on the ontogeny of the species and a certain amount of cytological investigation.

Relationships with other Genera

The question as to how far usual or well understood generic limits may be stretched without causing a complete breakdown in established concepts is particularly pertinent in the *Cruciferae*. In this family, the genera as often constituted are not wholly natural. This is true because of the tendency to include species which claim one or perhaps a few characteristics in common with those obviously belonging with the generic type, but which differ sufficiently to be definitely discordant. Large genera often receive many species in which the relationships are dubious and thus over a period of years may become so heterogeneous as to be almost an absurdity. It is the business of the monographer to evaluate and place anomolous species. In studying *Arabis*, it has been my policy to check carefully the generic character of each species under consideration before placing it unequivocally in the genus. While doing so, as one might expect in a genus dating from Linnaeus, several species have been found to be quite out of place.

In America, the nearest related genus to *Arabis* is *Sibara*. In 1896, Greene[1] proposed the anagram *Sibara* as a generic name for a number of species with common characters previously placed by various authors in *Arabis, Cardamine, Sisymbrium* and *Nasturtium*. These species seemingly are more closely re-

[1] Pittonia **3**: 10 (1896).

lated to *Arabis* than to any other genus and, indeed, they have a number of characters in common with it. Greene failed to point out reliable differences between *Sibara* and *Arabis* and as a result many subsequent writers have not recognized his genus as a valid one. *Arabis* is related to *Sibara* through such species as *A. lyrata* and *A. arenosa* which belong to the so-called section *Cardaminopsis*. At least two recent students of the *Cruciferae*, von Hayek[1] and O. E. Schulz,[2] have given generic recognition to *Cardaminopsis*. I do not concur with them in the opinion that *Cardaminopsis* is a genus distinct from *Arabis*, but it must be admitted that *A. lyrata* and its relatives are not next door to *A. alpina*, the type of the genus. To add species to *Arabis* which are only remotely related, if at all, to *A. lyrata*, the latter being somewhere near the outer boundary of the generic limits, simply overruns the natural definitive lines of the genus. Such a practice carried to its logical conclusion in a family like the *Cruciferae* would only lead to the establishment of another absurd *Crucifera* as conceived by Krause.[3]

Sibara as a genus rests on the following characters which do not belong or belong only in part to *Arabis*: pectinate to pinnatifid, somewhat glaucous foliage; similar basal and cauline leaves; petiolate cauline leaves; annual or at very most biennial habit; absence of glandular tissue adjacent to the paired stamens; and the lack of an expanded pedicel-summit. The foliage of all the species of *Sibara* is highly dissected, varying from runcinate-pinnatifid to pectinate with many narrow divisions. This type of foliage is common in *Cardamine* and *Sisymbrium*, but is unknown in *Arabis* proper. The basal rosette is caducous or entirely absent in *Sibara*, but always the first formed leaves are similar to the cauline ones. In *Arabis*, a basal rosette is usually developed and in all cases the basal leaves are differentiated from the cauline. Such recent authors as von Hayek[4] and Villani,[5] among others, have stressed the configuration of the nectar-glands on the receptacle as being of fundamental importance in classifying the *Cruciferae*. It is undoubtedly

[1] Fl. Steiermark **1**: 477 (1908).

[2] Op. cit. p. 541.

[3] Sturm's Fl. Deutsch. **6**: 31–169 (1902).

[4] Beiheft Bot. Centralb. **27**: 127–335 (1911).

[5] Annali di Botanica **16**: 71–121 (1923).

true that they have overemphasized this character, since more variation in natural genera occurs than they have taken account of, but when used in conjunction with other characteristics, this feature is a useful tool to aid in clarification of generic lines. In *Arabis*, the glandular tissue of the nectaries is well-developed and surrounds the base of the single stamens, subtends or surrounds the base of the paired stamens, except in one small group, and often subtends or partially surrounds the base of each petal. *Sibara*, on the other hand, has poorly developed nectaries. The glandular tissue subtends or rarely almost surrounds the base of the single stamens in a thin mold, but is absent or obsolete elsewhere on the receptacle. The most noticeable difference between *Arabis* and *Sibara*, aside from the foliage, is the lack of an expanded pedicel-summit in the latter genus. *Arabis* always has the pedicel-summit expanded in such a way as to create an enlarged support for the receptacle and nectaries. On mature fruits, a rather abrupt narrowing from pedicel-summit to replum-base is evident. In *Sibara*, there is practically no change in diameter or only a slight gradual expansion between pedicel and replum-base. An obscure ring of sepal-, petal-, and stamen-scars and shriveled nectaries alone mark the outer part of the receptacle after mature siliques have been developed. Very small flowers and a branching habit give *Sibara* a habital symmetry which is distinctive in itself. Only one or two species of *Arabis* have flowers even approaching the small size of the largest flowers of *Sibara* and only a few species have a similar habital aspect.

The essential characters setting *Arabis* off from other genera possessing linear siliques are its accumbent cotyledons and siliques flattened parallel to the septum. One possible exception to the flattened siliques is found in *A. glabra*, but here the siliques are often somewhat flattened and are never more than semiterete. The nature of the siliques together with the distinctive creamy-yellow petals in *A. glabra* are used by some botanists, especially the European, to separate this species from *Arabis* as *Turritis glabra*. There can be no doubt but that *A. glabra* is somewhat related to *A. hirsuta* which it nearly parallels in distribution, and it seems preferable to retain it in *Arabis*.

In the related *Halimolobos*, the siliques are terete and the

seeds have incumbent cotyledons. These points, together with the general habit, seem to place *Halimolobos* nearer to *Sysimbrium* than to *Arabis*. Several species, such as *A. Whitedii* and *A. Hookeri*, with terete siliques and incumbent cotyledons are now more naturally placed with *Halimolobos*.

Arabis is sometimes placed near *Cardamine*, but it is not believed that these genera are at all closely related. The peculiar elastic valves, opening with a relatively wide band of replum-tissue remaining on each side, is a distinctive feature of *Cardamine* and *Dentaria*. It should be stressed that the stamens of *Arabis* are always tetradynamous. This aids in distinguishing it from genera like *Thelypodium* where the single and paired stamens are of equal length.

Relationships of the Species

The systematic classifications of *Arabis* presented by DeCandolle,[1] Meyer,[2] Prantl,[3] Watson,[4] v. Hayek,[5] N. Busch,[6] and O. E. Schulz,[7] though almost successively more complicated in the chronological order given, do not satisfactorily allow for the inclusion of the North American plants without separating obviously related species into different sections. The weaknesses of these attempts to arrange systematically the species of *Arabis* into sections result from the fact that there are no clearly defined groups within the genus. Furthermore, many of the workers did not have sufficient material to insure an inclusive treatment. In the older works the lack of representative species was the penalty imposed by the immaturity of the science itself, but the recent students have been more fortunate in this respect. However, even with a quantity of material available for study, the difficulty resulting from the lack of clearly defined subgenera or sections cannot be overcome. It is my conviction that among the western American species of *Arabis* truly natural subdivisions of the genus other than the species themselves are nonexistent. For this reason I have arranged these species in

[1] Syst. Nat. **2**: 214 (1821) and Prod. **1**: 142–148 (1824).
[2] Ledeb., Fl. Alt. **3**: 18–20 (1831).
[3] Engler & Prantl, Pflanzenf. **3**: 2 Abt. 192–193 (1891).
[4] Gray, Syn. Fl. N. Am. **1**: 159–167 (1895).
[5] Beih. Bot. Central. **27**: 204 (1911).
[6] Fl. Sib. et Orient. Ext. **4**, fam. **25**: 428–475 (1926).
[7] Engler and Harms, Pflanzenf. **17b**: 2 Aufl. 542–547 (1936).

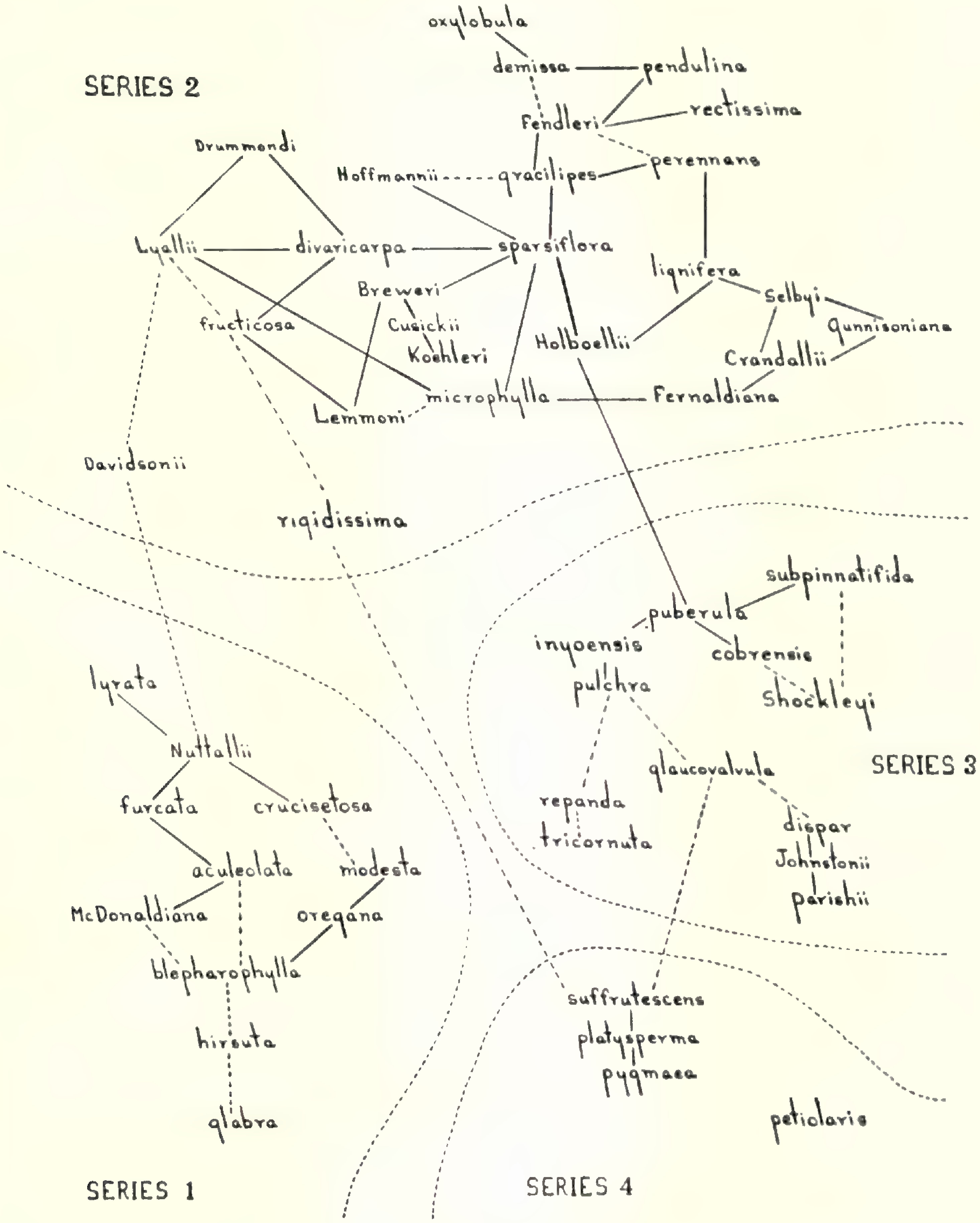

Fig. 1. Relationships in Arabis

four more or less interrelated series of no specified taxonomic rank. It should be understood that these divisions do not correspond to previously published sections of *Arabis*, and are used primarily for the purpose of indicating probable circles of affinity. The four series are presented in chart form as FIG. 1. Solid lines between species indicate a rather close relationship, broken lines indicate a probable distant relationship.

Species-Criteria

No single character, although it may appear to be very fundamental, can be solely relied upon positively to indicate relationships between species or to separate interrelated groups of species in *Arabis*. One group is likely to have the same or a similar interplay of characters as that found in another. A simple illustration of the point may be taken from the cases of *A. platysperma* and *A. suffrutescens*, whose close relationship to each other is obvious, and of *A. puberula* and *A. Shockleyi*, another related pair. The pedicel-position in one species of each pair is directly opposite that of the other. Thus, *A. platysperma* and *A. Shockleyi* have ascending pedicels, whereas *A. suffrutescens* and *A. puberula* have the pedicels reflexed. Taking pedicel-position as a criterion it is impossible to show that *A. platysperma* and *A. suffrutescens* are related but, when several characters are taken into account, the relationship is unmistakable. Numerous similar instances of parallel development in unrelated species and unrelated groups of species could be pointed out. This fact makes evident the necessity for great care in the evaluation of diagnostic characters. Furthermore, it is clear that a successful classification of *Arabis* must rest on a series of characters whose pattern has been carefully determined. In general, qualitative rather than quantitative differences are most reliable and should be given first importance in the characterization of the species.

Habit.—Most species of *Arabis* are strictly herbaceous, but many possess a woody caudex. In perennial species the caudex and root persist in a dormant state throughout any period inimical to growth, and leaves arise from the apex of the caudex or caudex-branches with the return of favorable growing conditions. The caudex shows special development in such desert species as

A. pulchra and *A. perennans* in which it is much elongated. Using desert shrubs for support, the leaves and flowering stems of these plants are often held from one to several decimeters off the ground. A number of tufted perennials have a highly branched caudex which may or may not be subterranean. In such cases many of the caudex-branches bear only leaves, while others bear both leaves and a fertile stem. Usually some remnants of shed leaves are to be found upon the caudex. Sometimes these are of a characteristic nature, as in *A. Koehleri*, in which the leaf-bases resemble the peg-like pulvini found on old twigs of *Picea*.

The stems may be either simple or branched even within a given species. Certain species show a marked constancy in possessing simple fertile stems, while others constantly possess branched stems. Plants which have been grazed are usually branched even though a simple stem is the normal habit of growth. Whether the stems are branched near the base or toward the top markedly affects the general symmetry of the plant. Thus, the position of the branching is sometimes of importance in distinguishing between entities, but this feature is usually not constant and must be used with caution.

The tap-root system is characteristic of *Arabis*, but that alone does not indicate that all species are either biennial or perennial as Hopkins[1] seems to have presumed. The plant which he treated as *Arabis virginica* (it is here transferred to *Sibara*) was said to be biennial.[2] Two lots of this plant have been grown from seed to the flowering stage in less than three months at the Harvard greenhouses. This would seem to indicate that it is usually annual in spite of its having a tap-root. All species of *Arabis* included in the present paper are either biennial or perennial.

Foliage.—Two sorts of leaves are found in *Arabis*. Those of the flowering stems are differentiated from those at the base of these stems or those terminating sterile branches of the caudex. The term "basal leaves" used throughout this paper refers to the leaves found at the base of fertile stems, those terminating caudex-branches or on the root-crown. The term "radical

[1] Rhodora **39**: 67 (1937).

[2] Ibid. p. 80.

leaves" has often been applied here but usually only the first year's rosette is truly radical. Leaves subsequently produced are not near the root in many cases but, strictly speaking, are stem-leaves, though different from the leaves of the fertile stem. The term "cauline leaves" is restricted to the leaves borne on the fertile stems.

The size and shape of the leaves are variable, but extremes in either may be characteristic of certain species and are useful in their delimitation. The leaves are entire, dentate or rarely more highly dissected. These features, though variable, are useful when only extremes are considered. The strongly perennial species usually have entire or nearly entire leaves. Many species have cauline leaves with auricled bases, while in others no auricles are present. This feature has been widely used as a species-criterion but it is unstable and may be relied upon only in some cases.

The basal leaves are always petiolate, while the cauline leaves are only rarely so. In western America only four species with petiolate cauline leaves are known. The cauline leaves usually diminish in size from base toward apex of the flowering stem. The basal leaves are often caducous, hence they may not be present on mature plants, as in *A. canadensis* and *A. tricornuta*. However, most of the species in our area have the basal leaves present even in old plants.

Vestiture.—The trichomes of *Arabis* are single-celled and never glandular. They may be simple, bifurcate with branches appressed (malphigiaceous) or variously branched. The term stellate has usually been applied to trichomes of the *Cruciferae* with several to many branches. Most of the highly branched types are actually not stellate, if by that term is meant a centrally attached hair with branches radiating from the middle after the manner of a star. The severally branched trichomes commonly found in *Arabis* are nearly all of a dendritic type, i. e., with a central trunk and irregularly placed, elevated branches. These branches themselves often fork, giving rise to new branches, thus forming a tree-like configuration. The fact that truly stellate trichomes are common in the *Cruciferae* and other plant families has made it desirable to distinguish the tree-like hairs by applying to them the term dendritic.

The type of trichome, whether simple, malphigiaceous, stellate, dendritic, swollen at base, terete or flattened, is of considerable importance in characterizing many species. A few species have two kinds of pubescence, but the association is usually fairly stable. The significance of the size of trichomes is not fully understood. Large differences in size may be safely used in support of other characters, but within at least a few species the trichomes vary considerably in size. An unsuccessful attempt was made to correlate trichome-size with polyploidy in *A. divaricarpa*. Further data are needed to determine whether polyploidy has the same effect on trichome-size as on the size of cells and stomata.

The density and extent of the pubescence on plants of *Arabis* are ecologically plastic and vary seasonally. Though often used with a great deal of assurance, the mere presence or absence of pubescence is a weak criterion. Specific observations on this point are discussed in some detail under *A. Drummondi.*

FLOWERS.—In general the flowers are similar throughout *Arabis*. They are always tetradynymous. Large differences in size may be utilized in differentiating some species, while in others there is considerable variation and size-differences are not reliable. Measurements to be useful comparatively must include the limits of variation in the size of any given part or organ. When accurately determined and based on a sufficient sample of the total population of a species they may be highly reliable. Unfortunately, it is only in some cases that such a procedure can be followed by a taxonomist because of lack of material.

The inner sepal-pair of the *Arabis* flower is never saccate at base. However, the outer pair is sometimes slightly saccate and in a few instances markedly so. The character is only limitedly usable. Petal-color varies from a deep purple to white in *Arabis*. *A. glabra* alone has a slightly yellowish petal.

The nectar-glands in the *Cruciferae* have been shown to be diversely specialized and it has been contended that their form, position and extent of development are of importance in the classification of the family. Beginning with Hildebrand in 1879 and Velenovsky in 1883 the nectar-glands have received increased attention. They formed the chief basis for a system

of the *Cruciferae* by Bayer[1] and were heavily relied upon by von Hayek[2] in his inclusive treatment of the family. In view of these facts, the glandular pattern in all species of *Arabis* included in the present paper has been carefully determined and diagrammed to see if this feature might be used as an aid in the characterization of species or species-groups. Contrary to the finding of Günthart,[3] where several types were found among European species, only two patterns were found. One type, in which the glandular tissue surrounds the base of the single stamen and is obsolete or entirely absent elsewhere on the receptacle, is confined to series one. In the rest of the species, the glandular tissue forms a continuous mold beneath all stamens and often has short projections flanking the petal-base. Thus it is clear that the glandular pattern is of no particular importance in any attempt to distinguish between the species themselves, although it may be used to some extent in separating groups of species.

SILIQUES.—The mature silique, as in other *Cruciferae,* is of paramount significance. The shape is, in general, narrowly linear with the valves strongly flattened parallel to the septum. An exception is the semi-terete capsule of *A. glabra.* Although the size of the silique is variable, there are recognizable limits to the variation and, if accurately determined, size becomes a useful tool in characterizing certain species. The central nerve of the valves is variously developed in different species, and a limited use may be made of this feature if it is carefully applied in conjunction with other characters. The cellular pattern of the septum is distinctive in a few species but, on the whole, it is so uniform and difficult of determination that little use has been made of it. The siliques of most species of *Arabis* are glabrous but in some they are always pubescent, while in a few species they may be either pubescent or glabrous.

Silique-position is constant in most species and the usefulness of this feature in determining species of *Arabis* is well known. However, in a few instances the siliques vary considerably in their position with respect to the rachis within a given entity. Among different species the siliques vary all the way from a

[1] Beih. Bot. Central. **18**: 119–180 (1905).

[2] Op. Cit.

[3] Reprint from Bibl. Bot. **77**: 1–36 (1912).

strictly erect position to a closely reflexed one. The siliques may be straight, curved or even strongly bow-shaped. The presence or absence of an elongated style upon the mature silique is a character which may be trusted within certain groups. An unusual development of the style is found in *A. Parishii* and it is only slightly less prominent in *A. Johnstonii.*

Seeds.—The shape and size of the seeds and the absence or extent of development of wings are significant. Whether the seeds are in one or two rows in each locule has frequently been the basis for the segregation of species. Considering the point of attachment, the seeds are always in two rows, the attachment being at the point of replum-junction on both sides of the locule. In certain species the seeds do not enlarge to the full width of the locule, hence the seeds themselves appear to be in two rows. In other species, the seeds entirely occupy the locule-width and are then said to be in one row. The difference is not a morphological one and is more apparent than real in so far as the actual number of rows of seeds in each locule is concerned. It is clear, then, that it might be possible for the seeds to be in neither one row nor two, but half-way between. This is precisely what happens in some species. In others the character is very constant. It will be seen that the real significance is to be attached to the relationship between seed-size and silique-width. My use of the terms uniseriate and biseriate refers to the position of the seed rather than to the actual number of rows as determined by seed-attachment. The cotyledons are accumbent in all the species presented in the present paper.

Geographical Distribution

The geographical area occupied by each species dealt with has been carefully determined and mapped. Maps showing the distribution of all species and varieties not extremely localized, except the widespread *A. glabra* and *A. hirsuta,* are presented on several pages appropriately placed in the general treatment. Many more specimens than could be cited were included in the data assembled for the maps. These geographical data have been of considerable value in determining natural boundaries of the species and varieties. Where a question as to the distinct-

ness or relationship of a variety or species has arisen, a comparison of the areas occupied by the related forms has usually been decisive. In addition to the horizontal area occupied by the species, the altitudinal zone in which they normally grow has been considered. The habitat and soil-preferences have also received attention whenever the data have been available. *Arabis* is indigenous to all the general habitats represented in the area, including high alpine and desert situations.

No one limited area in western America is conspicuous because of the number of endemic species of *Arabis* contained within it. The endemic species are quite generally distributed among the Rocky Mountains, Sierra Nevada Mountains, northern Coast Ranges in California, Siskiyou Mountains, Cascade Mountains and the deserts or lesser mountain systems in the intervening region. One species, *A. Hoffmannii*, is exclusively insular, being found only on Santa Cruz Island. Plants of the genus extend from Alaska on the north to northern Baja California on the south. Throughout the paper, where geographical distribution has been of special importance, it has been discussed under the species concerned. Many of the accompanying maps were based on Goode *Base Map* no. 102; by permission of the University of Chicago Press.

Cytology

In addition to the usual techniques employed in Systematic Botany, some species have been examined cytologically. As a result of these studies it has become clear that certain species usually considered to be highly complex taxonomically are apt to contain a polyploid series. *A. hirsuta* in America, *A. Holboellii*, *A. Fendleri* and *A. divaricarpa* are species of this type. Far more work is necessary before the variations and complexities of these species will be fully understood, but it is now definitely known that there are polyploid plants in all of them.

Results of the cytological examination of thirty-four collections of *Arabis* are presented in the table following, which contains chromosome-numbers for eighteen species and varieties. All but four are reported for the first time. The counts were made from material gathered directly at the locality given or from plants grown from seed collected at these stations. Except for one or two instances, specimens have been preserved

and may be consulted at the Gray Herbarium under the number cited. Counts were made from pollen mother-cells, using aceto-carmine smears, or from root-tips, using a modification of Fuelgen's technique. Unfortunately, it has been impossible to obtain sufficient data to make more than one or two general statements concerning the cytology of *Arabis*. Although several interesting problems have arisen, their solution has not been attempted, but it is hoped they will be mastered during future work in the genus.

On the basis of Jaretzky's[1] report of the chromosome-numbers for ten species of *Arabis*, Manton[2] gave the number eight as the fundamental one for the genus. Recently, Frank H. Smith,[3] after finding six pairs of chromosomes in *A. dentata* and seven in *A. laevigata*, doubted whether eight was necessarily the basic number for the genus. A glance at the table below will show that a haploid number of seven is by far the commonest among the species investigated. Undoubtedly seven is to be considered one of the fundamental chromosome-numbers of *Arabis*.

Chromosome-Numbers in Arabis

Species	Place of Collection	Collector and Number	N	2N
A. alpina	Harvard Botanic Garden, Cambridge	Rollins s. n.	8	16
A. alpina	Gaspé Co., Quebec	Knowlton s. n.		16
A. cobrensis	Uinta Co., Wyoming	Rollins 1656	7	
A. Crandallii	Gunnison Co., Colorado	Rollins 2093	7	
A. Crandallii	Gunnison Co., Colorado	Rollins 2084	7	
A. divaricarpa	Uintah Co., Utah	Rollins 1767	15	
A. divaricarpa	Larimer Co., Colorado	Rollins 2400	8	
A. Drummondi	Uintah Co., Utah	Rollins 1764	7	
A. Drummondi	Hinsdale Co., Colorado	Rollins 1506	7	14
A. Fendleri				
var. typica	Gunnison Co., Colorado	Rollins 2098	7	14?
var. typica	Costilla Co., Colorado	Rollins 1288	21	
var. spatifolia	Fremont Co., Colorado	Rollins 2069	7	14
var. spatifolia	Chaffee Co., Colorado	Rollins 2077	7	
var. spatifolia	San Juan Co., Colorado	Rollins 1511	14	
A. Gunnisoniana	Gunnison Co., Colorado	Rollins 2090	7	
A. hirsuta				
var. pycnocarpa	Windham Co., Connecticut	Weatherby and Rollins s. n.	16	

[1] Jahrb. Wiss. Bot. **68**: 1–45 (1928).

[2] Annals Bot. **46**: 516 and 543 (1932).

[3] Am. Journ. Bot. **25**: 220 (1938).

Species	Place of Collection	Collector and Number	N	2N
var. pycnocarpa	Daggett Co., Utah	Rollins 2267	32	
var. pycnocarpa	Gunnison Co., Colorado	Rollins 1427	16	32
A. Holboellii				
var. retrofracta	Sublette Co., Wyoming	Ownbey 1008	7	
var. retrofracta	Albany Co., Wyoming	Rollins 1070	7	
var. retrofracta	Larimer Co., Colorado	Rollins and Chambers 2401	7	
var. retrofracta	Mesa Co., Colorado	Rollins 2188	7	
var. retrofracta	Uintah Co., Utah	Rollins 1765	14	
var. retrofracta	Humboldt Co., Calif.	Harris et al. 3417	7	14
var. pinetorum	Lake Co., Colorado	Rollins 1349	21	
var. pinetorum	Gunnison Co., Colorado	Rollins 1426	14	
A. laevigata	Litchfield Co., Connecticut	Weatherby s. n.	7	
A. lignifera	Uinta Co., Wyoming	Rollins 2308	7?	14
A. lignifera	Montrose Co., Colorado	Rollins 2129	7	
A. lyrata	Litchfield Co., Connecticut	Weatherby s. n.	8	
A. microphylla				
var. typica	Wallowa Co., Oregon	Constance 1274	7	
var. saximontana	Big Horn Co., Wyoming	Williams 3264	14	
A. perennans	Mesa Co., Colorado	Rollins 2128	7	14
A. repanda	Madera Co., California	Constance 2386	7	

Chromosome-Numbers in Arabis—(*Continued*)

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Palo Alto (DS); herbarium of the Field Museum, Chicago (F); herbarium of the U. S. Forest Service, Washington, D. C. (FS); Gray Herbarium of Harvard University, Cambridge (G); the herbarium of Dr. Eric Hultén, Lund, Sweden (L); herbarium of the Missouri Botanical Garden, St. Louis (M); herbarium of the National Arboretum, Washington, D. C. (NA); herbarium of the University of Notre Dame, Notre Dame (ND); herbarium of the New York Botanical Garden, New York (NY); herbarium of the University of Oregon, Eugene (O); herbarium of Oregon State College, Corvallis (OS); Pomona College Herbarium, Claremont (P); the herbarium of Mr. Frank W. Peirson, Altadena, Calif. (Peirs); herbarium of the Academy of Natural Sciences of Philadelphia, Philadelphia (Ph); the Rocky Mountain Herbarium of the University of Wyoming, Laramie (RM); herbarium of the U. S. Field Station at Sacaton, Arizona (Sac); the herbarium of Mr. J. W. Thompson, Seattle (T); the Intermountain Herbarium of the Utah Agricultural College, Logan (UAC); herbarium of the University of California, Berkeley (UC); herbarium of the University of California at Los Angeles, Los Angeles (UCLA); herbarium of the University of Idaho, Southern Branch, Pocatello (UIP); herbarium of the U. S. National Museum, Washington, D. C. (US); herbarium of the University of Washington, Seattle (UW); Vegetation Type Map Herbarium, U. S. Forest Service, located at the University of California, Berkeley (VTM); herbarium of Willamette University, Salem, Oregon (W); herbarium of the State College of Washington, Pullman (WSC). The symbols in parenthesis are those used to indicate the herbarium where the specimens cited throughout the text were seen. Collections marked (R) are in my own herbarium.

Synopsis of the Genus Arabis L. in Western North America

Arabis L. Biennial or perennial herbs, often with a ligneous base, glabrous to sparsely or densely pubescent with simple, bifurcate, stellate or dendritic trichomes; caudex simple or branched; stems terete, leafy, simple or branched; basal leaves petiolate, entire, dentate or rarely somewhat dissected, persistent or caducous; cauline leaves sessile or rarely petiolate, often auricled, approximate to remote, entire or dentate; inflorescence racemose, ebracteate, greatly elongating as the flowers succes-

sively expand; flowers erect to reflexed at anthesis, tetradynymous; sepals erect, oblong to nearly ovate, uniform, or the outer pair infrequently saccate, bounded on the sides and apex by a narrow non-chlorophyllous margin; petals spatulate to oblong, less frequently narrowly obovate, white to deeply purple, rarely stramineous; filaments linear to narrowly subulate, entire, erect, straight or the single ones rarely curved upwards from their base; anthers oblong; nectar-glands in a continuous mold beneath all stamens to merely subtending the base of the single stamens; siliques linear, straight or curved, erect to reflexed, sessile or very rarely with a short gynophore, flattened parallel to partition, rarely semi-terete, two-valved; valves prominently one-nerved to completely nerveless in rare instances, sometimes minutely net-veined; style prominent or none; stigma entire to rarely somewhat bilobed; septum nerveless or with a variable central band of differentiated tissue; seeds numerous, pendulous, orbicular to nearly oblong, flattened or plump, winged or wingless, uniseriate to biseriate, funiculus free or nearly so, cotyledons accumbent.—L., Sp. Pl. **2:** 664 (1753); Gen. Pl., ed. 5, 298 (1754); DC., Syst. **2:** 213–244 (1821) and Prod. **1:** 142–149 (1824); Hooker, Fl. Bor.-Am. **1:** 41–43 (1829); Torrey & Gray, Fl. N. Am. **1:** 79–83 (1838); Gray, Gen. Illustr. **1:** 141, pl. 58 (1848); Watson in Gray, Syn. Fl. **1:** 159–167 (1895); Howell, Fl. Northw. Am. **1:** 42–46 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 291–295 (1906); Coulter & Nelson, New Man. Bot. Rky. Mts. 225–229 (1909); Wooton & Standley in Contrib. U. S. Nat. Herb. **19:** 279–280 (1915); Henry, Fl. So. Brit. Columb. 149–150 (1915); Rydberg, Fl. Rky. Mts. 356–363 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 241–245 (1925); Jepson, Man. Fl. Pl. Calif. 427–433 (1925) and Fl. Calif. **2:** 59–73 (1936); Munz, Man. So. Calif. Bot. 202–205 (1935); Rollins in Res. Stud. State Coll. Wash. **4:** 1–52 (1936); O. E. Schulz in Engler, Pflanzenf. 2 Aufl., **17b:** 542 (1936); Hopkins in Rhodora **39:** 63–98, 106–148, 156–186 (1937). *Turritis* L., Sp. Pl. **2:** 666 (1753); Gen. Pl. ed. 5, 298 (1754); DC., Syst. **2:** 211–13 (1821) and Prod. **1:** 139–140 (1824); Hooker, Fl. Bor.-Am. **1:** 40–41 (1829); Torrey & Gray, Fl. N. Am. **1:** 78 (1838); Gray, Gen. Illustr. **1:** 143, pl. 59 (1848). Lectotype species—*A. alpina*, L.

Artificial Key to the Species

A. Seed-wing 1–3 mm. wide or, if slightly less, then cauline leaves petiolate; seeds (including wings) 2.5–5 mm. long; siliques 3–8 mm. wide (rarely slightly narrower)......B.

B. Cauline leaves petiolate, the lower dissected to the midrib; petiole not winged; basal leaves 10–15 cm. long; Texas..53. *A. petiolaris.*

B. Cauline leaves sessile, or if petiolate, then the petiole winged, entire or merely dentate; basal leaves less than 8 cm. long..................................C.

C. Siliques and pedicels erect or ascending............D.

D. Lower cauline leaves petiolate; petiole winged; basal leaves oblanceolate to broadly spatulate, 1–3 cm. wide; petals equaling or only slightly exceeding sepals; Nevada and California ....45. *A. repanda.*

D. All cauline leaves sessile; basal leaves linear to oblanceolate, less than 8 mm. wide; petals definitely exceeding the petals..........................E.

E. Leaves and lower stems hoary with a minute pubescence; pedicels pubescent; California ....47. *A. dispar.*

E. Leaves and stems green, glabrous or pubescent, but never hoary; pedicels glabrous...............F.

F. Basal leaves linear, about 2 mm. wide, densely hirsute with very coarse trichomes, persistent and forming successive hemispherical rosettes on the elongated crown; California ....52. *A. pygmaea.*

F. Basal leaves oblanceolate to spatulate, 3–8 mm. wide, glabrous or pubescent with much finer trichomes than the above, deciduous, not forming successive rosettes on the crown; Nevada, California and Oregon................51. *A. platysperma.*

C. Siliques and pedicels reflexed (horizontal in *A. suffrutescens,* var. *horizontalis*)....................G.

G. Leaves and stems green, glabrous or pubescent below only; siliques attenuate at apex; seeds uniseriate; Idaho to California and Washington........50. *A. suffrutescens.*

G. Leaves and stems hoary with a minute pubescence; siliques obtuse at apex; seeds biseriate; California and Nevada...........................46. *A. glaucovalvula.*

A. Seed-wing less than 1 mm. wide or seeds wingless; seeds (including wings) less than 2 mm. long; siliques usually less than 3 mm. wide, very rarely up to 3.5 mm. wide..H.

H. Basal leaves obovate to broadly oblanceolate, obtuse and rounded at apex, often forming a flat rosette at base of stems, usually rather thin, blade nearly as broad as long, glabrous or hirsute with simple or forked trichomes except in *A. crucisetosa, A. modesta* and var. *furcatipilis* of *A. glabra;* siliques erect or ascending; styles often evident; stems often hirsute with simple or forked trichomes near base; glandular tissue subtending single stamens only, or disrupted and poorly developed near paired stamens; outer sepals saccate except in *A. glabra*...I.

I. Seeds biseriate; siliques semi-terete; flowers creamy-yellow (rarely lilac); cauline leaves ample, ovate to ovate-lanceolate, usually glaucous; widely distributed from Quebec to California.........................1. *A. glabra.*

I. Seeds uniseriate; siliques flattened parallel to septum; flowers white to purple; cauline leaves much smaller except occasionally in *A. hirsuta,* obovate to oblong, rarely if ever glaucous..........................J.

J. Seeds definitely winged at least at the distal end; flowers purple to white........................K.

K. Plants completely glabrous......................L.

L. Basal leaves 3–8 cm. long, broadly oblanceolate, entire or rarely few-toothed; California to Oregon................................12. *A. Davidsonii.*

L. Basal leaves less than 2.5 cm. long, ovate to spatulate, dentate to rarely entire..........M.

M. Flowers purple; petals truncate at apex; plants of California................6. *A. McDonaldiana.*

M. Flowers white; petals rounded at apex; plants of Washington and northern Oregon......8. *A. furcata.*

K. Plants pubescent at least on lower stems and basal leaves ....N.

N. Flowers purple, showy; petals 9–20 mm. long; pedicels pubescent........................O.

O. Petals 4–8 mm. broad, rounded at apex or retuse; plants pubescent at least on lower stems and basal leaf-margins.............P.

P. Plants more than 2 dm. high; siliques acute, 3.5–6.5 cm. long; style slender or obsolete; southern Oregon and extreme northern California ....Q.

Q. Lower stems appressed-pubescent; basal leaves not ciliate; pubescence of uniform, small dendritic trichomes.............5. *A. modesta.*

Q. Lower stems hirsute; basal leaves ciliate, pubescence of large simple, forked or dendritic trichomes.

Caudex multicipitally branched; basal leaves 1–4 cm. long, hirsute and ciliate with large white simple or rarely forked trichomes; cauline leaves 5–15 mm. long..........7. *A. aculeolata.*

Caudex simple or rarely closely branched; basal leaves 3–8 cm. long, pubescent with large dendritic or forked trichomes with bulbous bases; cauline leaves 2–5 cm. long........4. *A. oregana.*

P. Plants less than 2 dm. high; siliques 2–4 cm. long, obtuse, usually with a stoutish style; south from Sonoma Co., California 3. *A. blepharophylla.*

O. Petals 2.5–3 mm. broad, usually truncate at apex; plants usually glabrous, but rarely with a few marginal trichomes on the basal leaves 6. *A. McDonaldiana.*

N. Flowers white, rarely pinkish; petals less than 11 mm. long; pedicels glabrous or very rarely sparsely hirsute in *A. hirsuta.*

Stems glabrous; pedicels divaricately ascending; siliques 2–4 cm. long; cauline leaves not auriculate; Oregon and Washington. .8. *A. furcata.*

Stems hirsute at least below; pedicels erect, rarely divaricately ascending; siliques 3–6 cm. long; cauline leaves auriculate; widely distributed.............................2. *A. hirsuta.*

J. Seeds wingless; flowers white....................R.

R. Basal leaves hirsute with large simple or rarely forked trichomes to glabrous; lower stems hirsute with spreading trichomes or glabrous.

Basal leaves entire; lower cauline leaves sessile; styles 1 mm. or more long; Montana to Utah and Washington....................9. *A. Nuttallii.*
Basal leaves lyrate-pinnatifid to dentate; lower cauline leaves usually petiolate; styles less than 1 mm. long or absent; Washington to Saskatchewan and Alaska. .11. *A. lyrata,* var. *kamchatica.*
R. Basal leaves rather densely pubescent on both surfaces with dendritic trichomes, never ciliate; lower stems appressed-pubescent to glabrous; Idaho and Washington....................10. *A. crucisetosa.*
H. Basal leaves linear to linear-oblanceolate (if broader, then minutely pubescent or the siliques reflexed or both), acute or rarely obtuse, usually thick, rarely rounded at apex, ascending, not forming a flat rosette at base of stems; pubescence varied or absent; siliques erect to reflexed; glandular tissue continuous beneath all stamens; outer sepals non-saccate or only slightly so..S.
S. Leaves, stems and pedicels hoary with a very minute pubescence; mostly desert plants or plants from mountain ranges bordering the deserts............T.
T. Siliques erect or ascending to widely spreading; pedicels erect to spreading at right angles to rachis...U.
U. Styles less than 1 mm. long or the stigma sessile; basal leaves narrowly oblanceolate............V.
V. Seeds uniseriate, winged, flattened, 1.5–2.5 mm. broad.
Seed-wing over 0.5 mm. wide; siliques 2.5–3.5 mm. wide, divaricately ascending; California.................................47. *A. dispar.*
Seed-wing less than 0.5 mm. wide; siliques about 2 mm. wide, spreading at right angles; California....................42. *A. inyoensis.*
V. Seeds biseriate, essentially wingless, plump, about 1 mm. broad; Utah to California..........41. *A. Shockleyi.*
U. Styles 1–8 mm. long; basal leaves linear.
Styles 4–8 mm. long; seeds narrowly winged; siliques 1–2 cm. long; California............49. *A. Parishii.*
Styles 1–3 mm. long; seeds broadly winged; siliques 3–5 cm. long; California..........48. *A. Johnstonii.*
T. Siliques reflexed; pedicels strongly reflexed to pendulous....................................W.
W. Seeds biseriate; cauline leaves linear, not crowded, entire; Colorado to California ....43. *A. pulchra.*
W. Seeds uniseriate; cauline leaves oblong to broadly lanceolate, crowded, often subpinnatifid.
Siliques blunt at apex; style wanting; petals 7–10 mm. long; Idaho to California and Washington...........................38. *A. puberula.*
Siliques acuminate at apex; style about 1 mm. long; petals 10–14 mm. long; California and Oregon ....39. *A. subpinnatifida.*
S. Cauline leaves, stems and pedicels greenish, densely pubescent to glabrous, never hoary; basal leaves sometimes hoary-pubescent, but usually greenish, densely pubescent to glabrous...................X.

X. Mature fruiting pedicels erect to ascending, never diverging at right angles to rachis or descending; siliques erect, ascending or more rarely arcuate. . Y.

Y. Basal leaves narrowly oblanceolate to spatulate or rarely almost linear, pubescent to glabrous, but not hirsute with large spreading simple or forked trichomes; lower cauline leaves variously pubescent or glabrous, but not hirsute, auriculate to non-auriculate ....Z.

Z. Lower fruiting pedicels 2–4 cm. long, glabrous; siliques arcuate or at least somewhat curved; seeds biseriate.

Lower stems densely hirsute; siliques nerved below, not coriaceous; lower cauline leaves pubescent on both surfaces; Arizona. .25. *A. gracilipes.*

Lower stems glabrous to very sparsely pubescent with appressed trichomes; siliques nerveless, thick and coriaceous; lower cauline leaves glabrous above; Santa Cruz Island, California..................27. *A. Hoffmannii.*

Z. Lower fruiting pedicels less than 2 cm. long, pubescent or glabrous; siliques straight to arcuate, if arcuate, then the seeds uniseriate. .a.

a. Basal leaves and lower cauline leaves densely pubescent with dendritic trichomes, gray, often pannose or appearing so; siliques straight to somewhat curved or arcuate; stems usually numerous from a much-branched caudex.........................b.

b. Basal leaves linear to linear-oblanceolate, usually less than 5 mm. broad; siliques straight except in *A. Koehleri* and *A. sparsiflora*............................c.

c. Petals less than 7 mm. long; stigmas mostly sessile; styles rarely up to 1 mm. long..........................d.

d. Basal leaves pannose, very finely pubescent; cauline leaves oblong to narrowly ovate, crowded near base; pedicels pubescent; lower stems finely pubescent.........................e.

e. Siliques about 1 mm. wide, erect, valves constricted between seeds; seeds wingless to very narrowly winged; Colorado.....................33. *A. Crandallii.*

e. Siliques 1.5–2 mm. wide, divaricately ascending, valves not constricted between seeds; seeds definitely winged.

Siliques acuminate at apex; style about 1 mm. long; cauline leaves non-auriculate; Nevada
32b. *A. Fernaldiana* var. *stylosa.*

Siliques blunt at apex; stigma sessile, cauline leaves auriculate; Nevada and California
18d. *A. Lemmoni* var. *depauperata.*

d. Basal leaves not pannose, though often appearing so to the naked eye; cauline

leaves narrowly lanceolate, remote; pedicels glabrous; lower stems hirsute to glabrous; Wyoming to Nevada and Washington ....31. *A. microphylla.*

e. Petals 7–14 mm. long; styles about 1 mm. long or stigmas sessile ....f.

f. Basal leaves linear, rather coarsely pubescent, not pannose, acute; siliques usually curved; caudex-branches elongated.

Plants 3–9 dm. high; pedicels pubescent or glabrous; lower stems pubescent or rarely glabrous; caudex without numerous peg-like leaf-bases; widely distributed from the Rocky Mountains to California and Yukon ....26. *A. sparsiflora.*

Plants mostly less than 3 dm. high; pedicels glabrous; lower stem glabrous or rarely sparsely pubescent; caudex covered with numerous peg-like leaf-bases; southern Oregon 30. *A. Koehleri.*

f. Basal leaves linear-oblanceolate, minutely pubescent, pannose, obtuse; siliques straight; caudex-branches not elongated.

Style absent, stigma sessile; pedicels and siliques divaricate; California ....42. *A. inyoensis.*

Style about 1 mm. long; pedicels and siliques erect; Nevada ......32. *A. Fernaldiana.*

b. Basal leaves oblanceolate, often broadly so, 6–15 mm. wide; siliques somewhat curved ....g.

g. Stems and pedicels hirsute with spreading trichomes; cauline leaves ovate to broadly oblong, mostly approximate; California and southern Oregon......28. *A. Breweri.*

g. Stems and pedicels pubescent with minute appressed trichomes to glabrous; cauline leaves lanceolate, remote; Colorado....35. *A. Selbyi.*

a. Basal leaves pubescent to glabrous, greenish, never pannose; lower leaves and stems glabrous to sparsely pubescent; siliques straight; stems one to several or many; caudex usually simple except in *A. Lyallii* and *A. fructicosa* ....h.

h. Siliques 1.5–3.5 mm. wide; seeds orbicular to oblong, 1–2 mm. broad; stems glabrous to appressed-pubescent below, never hirsute with spreading trichomes ....i.

i. Seeds biseriate, oblong, winged on one side and the distal end; siliques and pedicels erect; siliques usually blunt; basal leaves strigose with malphigiaceous hairs or glabrous; flowers white, very rarely pinkish; widely distributed .....14. *A. Drummondi.*

i. Seeds uniseriate or rarely imperfectly biseriate, orbicular, winged all around; siliques and pedicels divaricately ascending to erect, siliques usually acute; basal leaves pubescent with three- to several-branched trichomes or glabrous; flowers pink to purple ....j.

j. Plants less than 3 dm. high; stems several to numerous from a branching caudex; siliques and pedicels erect to slightly divergent; widely distributed ......13. *A. Lyallii.*

j. Plants 3–9 dm. high; stems usually single, rarely two or three from a simple caudex; siliques and pedicels divaricately ascending to more widely spreading. .k.

k. Siliques 1.5–2.5 mm. wide, margin straight; seeds 1–1.5 mm. broad.

Basal leaves sparsely pubescent with minute dendritic trichomes; cauline leaves glaucous, ovate; siliques glaucous, nerved only at very base or nerveless; Wyoming (rare) ....16. *A. fructicosa.*

Basal leaves sparsely pubescent with appressed several-branched, rather coarse trichomes or glabrous; siliques not glaucous, nerved at least to the middle; caudex simple; widely distributed. ....15. *A. divaricarpa.*

k. Siliques 2.5–3.5 mm. wide, margin undulate; seeds 2–2.5 mm. broad; California ....17. *A. rigidissima.*

h. Siliques less than 1.5 mm. wide; seeds orbicular, about 1 mm. broad; stems sparsely hirsute at base; Wyoming to California and British Columbia ....31. *A. microphylla.*

Y. Basal leaves narrowly linear, densely hirsute with large simple or forked trichomes; lower cauline leaves hirsute, linear, non-auriculate; Idaho to Oregon and Washington ....29. *A. Cusickii.*

X. Mature fruiting pedicels diverging at right angles to strictly reflexed; siliques straight to arcuate, diverging at right angles to rachis to strictly reflexed ....l.

l. Basal leaves definitely ciliate with large acerose simple or forked trichomes, rarely glabrous, blades hirsute with simple or forked hairs to glabrous; pedicels glabrous, gently curving downward except in *A. rectissima* where they are geniculately reflexed ....m.

m. Siliques pendulous on gently curving pedicels, never appressed to rachis; basal leaves linear to broadly oblanceolate ....n.

n. Plants 2.5–6 dm. high; stems few to several, fairly robust; seeds biseriate; lower cauline leaves crowded to slightly overlapping or remote; pedicels 1–2 cm. long.

Siliques 2–4 cm. long; cauline leaves small, mostly remote; basal leaves hirsute with simple trichomes to glabrous; Utah and Nevada ....21. *A. pendulina.*

Siliques 4–6 cm. long; cauline leaves fairly ample, lower imbricated; basal leaves hirsute on the blade-surfaces with forked trichomes, ciliate with simple or forked trichomes; Wyoming to Texas, Mexico and Nevada........................23. *A. Fendleri.*

n. Plants caespitose, 1–3 dm. high, usually less than 2 dm. high; stems slender; seeds uniseriate except in *A. pendulina;* cauline leaves remote; pedicels 3–10 mm. long ....o.

o. Seeds biseriate; siliques blunt, 2–3 mm. wide ....21. *A. pendulina.*

o. Seeds uniseriate; siliques slightly tapering at apex; 1.5–2 mm. wide.

Siliques definitely pendulous, acute to obtuse; at least some of the basal leaves densely hirsute; Wyoming, Colorado and Utah ....20. *A. demissa.*

Siliques almost oblique to widely pendulous, acuminate; basal leaves glabrous, thin; Colorado (rare) ....19. *A. oxylobula.*

m. Siliques strictly reflexed, appressed to rachis; pedicels geniculate; basal leaves oblanceolate to slightly broader; California and Oregon 22. *A. rectissima.*

l. Basal leaves densely pubescent with fine to coarse dendritic trichomes, blades always pubescent, never merely hirsute with simple or forked hairs; pedicels pubescent to glabrous, spreading at right angles to strictly reflexed ....p.

p. Cauline leaves sessile, never petiolate; filaments of single stamens straight, erect; petals at least one-third longer than the sepals .....q.

q. Seeds uniseriate; cauline leaves lanceolate to oblong or ovate, rarely linear; petals less than 12 mm. long, their limbs not spreading; siliques glabrous except occasionally in *A. Holboellii,* var. *retrofracta* ....r.

r. Basal leaves spatulate to oblanceolate, never linear; seed-wing less than 0.3 mm. wide; cauline leaves not pannose; stems rigid; siliques widely spreading to strictly reflexed ....s.

s. Pedicels 2–4 (–6) mm. long; siliques spreading at right angles to rachis; cauline leaves ovate, mostly glabrous; widely distributed ....18. *A. Lemmoni.*

s. Pedicels 6–20 mm. long; siliques spreading to reflexed; cauline leaves oblong to lanceolate, mostly pubescent ....t.

t. Mature fruiting pedicels spreading at right angles to rachis, straight or arched downward, not strongly descending or strictly reflexed; siliques straight and spreading at right angles or arcuate..u.

u. Plants 1–2 (–3) dm. high, caespitose; stems numerous, filiform; cauline leaves few, small and remote.
Cauline leaves linear-lanceolate, 1–2 cm. long; pedicels glabrous; stems hirsute below, usually branched; Wyoming to California and British Columbia .... 31. *A. microphylla.*
Cauline leaves oblong, 5–8 mm. long; pedicels pubescent; stems simple, densely pubescent, but not hirsute with spreading trichomes; Colorado .... 34. *A. Gunnisoniana.*
u. Plants 3–9 dm. high, rarely caespitose; stems one to several, fairly stout; cauline leaves usually numerous, crowded and overlapping near base of stem, except in *A. perennans* .. v.
v. Basal leaves entire, finely and densely pubescent with minute dendritic trichomes; stems densely appressed-pubescent at least below; pedicels sparsely pubescent to glabrous; stems several to few.
Pedicels and siliques rigidly spreading at right angles to rachis, straight; seed-wing 0.2–0.3 mm. wide; California .... 42. *A. inyoensis.*
Pedicels and siliques curved downward; siliques usually curved; seed-wing very narrow (less than 0.2 mm. wide); Wyoming to Arizona and Nevada .... 36. *A. lignifera.*
v. At least the outer basal leaves dentate, densely pubescent with coarse dendritic trichomes; stems mostly hirsute with spreading hairs below, rarely appressed-pubescent; pedicels often hirsute; stems one to several or many.
Outer basal leaves broadly oblanceolate, obtuse; pedicels slender, 1–2 cm. long, glabrous; petals 6–9 mm. long, 1.5–2.5 mm. wide; Colorado to Mexico and California .... 24. *A. perennans.*
Outer basal leaves narrowly oblanceolate, acute; pedicels stout, 5–12 mm. long, hirsute or appressed-pubescent in var. *californica;* petals 8–12 mm. long, 2–4 mm. wide; widely distributed .... 26. *A. sparsiflora.*
t. Mature fruiting pedicels definitely descending to strictly reflexed, straight, not widely spreading with tips descending; siliques mostly straight, pendulous to strictly appressed against the rachis .... w.

w. Pedicels strictly reflexed, appressed to the rachis; widely distributed . . 37. *A. Holboellii.*
w. Pedicels strongly descending, but not appressed to the rachis . . . . x.
x. Stems hirsute with spreading trichomes below; siliques straight or nearly so . . . . 37. *A. Holboellii.*
x. Stems finely appressed-pubescent below; siliques often slightly curved and usually widely pendulous; Wyoming to Arizona and Nevada . . 36. *A. lignifera.*
r. Basal leaves linear, minutely pubescent, usually pannose; seed-wing about 0.5 mm. wide; cauline leaves pannose; stems weak; siliques pendulous on widely spreading slender pedicels; Wyoming to Nevada and Oregon . . . . 40. *A. cobrensis.*
q. Seeds definitely biseriate; cauline leaves linear; petals 8–20 mm. long, usually showy, petal-limb spreading at right angles; siliques densely pubescent except in var. *gracilis;* Colorado to California and Mexico . . . . . . 43. *A. pulchra.*
p. Cauline leaves petiolate; filaments of single stamens arising at right angles to receptacle and curved upward; petals barely exceeding the sepals; Arizona . . . . 44. *A. tricornuta.*

1. A. GLABRA (L.) Bernhardi. Biennial or rarely perennial; stems one or few from a tap-root, simple or rarely branched above, stout, glabrous and glaucous above, pubescent (usually hirsute) below, 4–12 dm. high; basal leaves broadly oblanceolate to oblong or spatulate, petiolate, repand, dentate or sometimes rather deeply divided, rarely entire, coarsely pubescent with forked or dendritic trichomes, rarely almost glabrous, 6–15 cm. long, 1–3 cm. wide, petiole usually hirsute; cauline leaves lanceolate to ovate, entire or the lower toothed, sessile, auricled, sagittate, glabrous or the lower sparsely pubescent, 4–15 cm. long, 1–4 cm. wide; sepals oblong, non-saccate, obtuse, yellowish to rarely purplish, 3–5 mm. long; petals linear to narrowly spatulate, slender-clawed, yellowish-white or very rarely purplish, 5–7 mm. long; glandular tissue subtending single stamens, absent or nearly obsolete near paired stamens; siliques strictly erect, semi-terete to slightly more flattened, glabrous, 4–10 cm. long, slightly more than 1 mm. wide, valves nerved to the middle or often to the tip; style short and stout; stigma expanded; seeds oblong to nearly orbicular, wingless to very narrowly winged, biseriate or nearly so.

Pubescence of the stem simple or rarely forked, spreading . . 1a. Var. *typica.*
Pubescence of the stem several-branched, appressed . . . . 1b. Var. *furcatipilis.*

1a. Var. TYPICA Hopkins in RHODORA **39:** 106 (1937). *A. glabra* (L.) Bernh., Syst. Verz. Erf. 195 (1800). *Turritis glabra*

L., Sp. Pl. **2:** 666 (1753). *Arabis perfoliata* Lam., Dict. **1:** 219 (1793). *Turritis macrocarpa* Nuttall in T. & G., Fl. N. Am. **1:** 78 (1838). *Arabis macrocarpa* (Nutt.) Torrey in Bot. Mex. Boundary pt. 1: 32 (1858). *Turritis glabra*, var. *lilacina* O. E. Schulz in Fedde, Repert. Sp. Nov. **33:** 191 (1933).—Quebec to North Carolina, California and British Columbia. Only the leading synonyms have been given above. For full synonymy, references, and citations of specimens see Hopkins, l. c.

1b. Var. FURCATIPILIS Hopkins. Stems pubescent below with appressed, several-branched trichomes. Pubescence smaller than in var. *typica*.—RHODORA **39:** 109 (1937).—Utah and California. UTAH: Logan City Camp, Logan Canyon, Cache Co., *Maguire 3437* (G, TYPE). CALIFORNIA: without locality, *T. Bridges 15* (G); Santa Lucia Mts., Monterey Co., March, 1898, *Plaskett 53* (G).

A. glabra is abundant and widely distributed in the mountains of our area where it is usually found in habitats ranging from moist shady places to open dry disturbed soils. The total distribution is very wide in temperate Asia and Europe as well as in North America. This species is often removed from *Arabis* and placed in the genus *Turritis*, but the characters used to make the separation are not convincing. The distinctive characters supposedly include yellowish petals as opposed to white or purple ones, semi-terete instead of definitely flattened siliques and biseriate instead of uniseriate seeds. As shown above, the seed-position in the silique may be untenable even as a species-criterion in *Arabis*, therefore it is of even less value as a generic character. Furthermore, a number of undoubted species of *Arabis* have biseriate seeds. The siliques of *A. glabra* are only semi-terete and in many cases they are flattened as much as those of *A. hirsuta*. As for petal-color, *A. glabra* does not have exclusively yellowish petals. Sometimes the petals are pink or even purplish. Other minor characters such as the angular nature of the silique or the complete nervation of the valves are sometimes pointed to as being distinctive, but these are variable in *A. glabra* and cannot be satisfactorily used to bolster generic segregation.

Two varieties of *A. glabra* have been distinguished in America. O. E. Schulz in 1933 described *Turritis glabra*, var. *lilacina*,[1] basing it upon the lilac color of the petals and sepal-margins.

[1] Fedde, Repert. Sp. Nov. **33:** 191 (1933).

An isotype of this variety does not show the characters described by Schulz, but specimens from widely separated stations (Wyoming, *Rollins no. 991;* Idaho, *Rollins & Constance no. 1109* and Utah, *Garrett no. 2236*) have purplish to lilac-colored buds and newly expanded petals. The supposedly distinctive color fades to the usual straw-yellow as the flower fully expands. I do not consider plants with such dubious ephemeral characters to be worthy of any nomenclatorial recognition. In the case of Hopkins's var. *furcatipilis*,[1] a more fundamental character, that of pubescence-type, is used as a distinguishing character. The distribution of this variety, including as it does only isolated stations in northeastern Utah and western California, is peculiar. Perhaps the variety is not a natural one, but until more information is available on its distribution this cannot be determined.

2. A. HIRSUTA (L.) Scop. Biennial or perennial; stems erect, one to several from a simple or branching caudex, simple or branched above, hirsute with coarse, spreading, simple or forked trichomes (strigose with appressed malphigiaceous trichomes in var. *adpressipilis*), often glabrous above, 2–7 dm. high; basal leaves oblong to oblanceolate or broadly spatulate, short-petioled, obtuse to rarely acutish, entire, dentate or repand, hirsute on both surfaces with coarse simple or forked trichomes or rarely almost glabrous, 2–8 cm. long, 1–3 cm. wide; cauline leaves lanceolate to oblanceolate or nearly spatulate, acute or obtuse, sessile, auriculate, entire to coarsely dentate, hirsute on both surfaces or the upper glabrous, 1–5 (–7) cm. long, 0.5–2.5 cm. wide, approximate to remote; pedicels erect to divaricately ascending, glabrous or rarely sparsely hirsute, 0.5–1.5 cm. long; sepals oblong, glabrous or rarely with a few trichomes, 2.5–4.5 mm. long, about 1 mm. wide; petals white to rarely pinkish, oblong to spatulate, 3–9 mm. long; siliques erect, strict to divaricately ascending, glabrous, nerved below or nearly the entire length, 3–6 cm. long, 1–2 mm. wide; style 0.5–1 mm. long, stigma entire to slightly divided; seeds brown to blackish, suborbicular to nearly rectangular, prominently winged on the distal end to narrowly winged or wingless, 1–1.5 mm. long, about 1 mm. wide, uniseriate, cotyledons accumbent. The above description was drawn from American material.

[1] RHODORA **39**: 109 (1937).

Key to the American Varieties of A. hirsuta

a. Flowers small; petals 3–5 mm. long, white to yellowish-white; cauline leaves approximate to subremote, siliques strictly erect; outer sepals moderately saccate........b.

b. Stem-pubescence spreading, mostly simple.......2a. Var. *pycnocarpa*.

b. Stem-pubescence appressed, mostly malphigiaceous 2b. Var. *adpressipilis*.

a. Flowers larger; petals 5–9 mm. long, white to pinkish; cauline leaves mostly remote; siliques often somewhat divergent; outer sepals markedly saccate............c.

c. Siliques about 1 mm. wide; stigma nearly entire; cauline leaves usually entire; upper stem glabrous; inland in the mountains from California to British Columbia.....................................2c. Var. *glabrata*.

c. Siliques 1.5–2 mm. wide; stigma noticeably bifid; cauline leaves usually dentate; upper stem hirsute; chiefly near the Pacific Coast-line from Alaska to Oregon...............................2d. Var. *Eschscholtziana*.

2a. Var. **pycnocarpa** (Hopkins), comb. nov. Cauline leaves approximate to subremote; stems hirsute with simple or forked trichomes; siliques strictly erect, 3–5 cm. long; seeds winged on the sides and distal end.—*A. pycnocarpa* Hopkins in Rhodora **39:** 112 (1937); Deam, Fl. Indiana 505 (1940). *Turritis ovata* Pursh, Fl. Am. Sept. **2:** 438 (1816)? *T. oblongata* Raf. in Am. Mo. Mag. **2:** 44 (1817)? *Arabis* "(turritis ovata)" (Pursh) Poir. in Lam. Encycl. Suppl. **5:** 557 (1817)? *A. sagittata*, γ *ovata* (Pursh) DC., Prod. **1:** 144 (1824)? *A. hirsuta*, γ *ovata* (Pursh) T. & G., Fl. N. Am. **1:** 80 (1838)? *A. hirsuta* sensu Hooker, Fl. Bor.-Am. **1:** 42 (1829) in part; T. & G., Fl. N. Am. **1:** 80 (1838); Gray, Man. 36 (1848); Watson in Gray, Syn. Fl. N. Am. **1:** 162 (1895) in part; Britton & Brown, Ill. Fl. **2:** 149 (1897); Small, Fl. Se. U. S. 484 (1903); Piper in Contrib. U. S. Nat. Herb. **11:** 293 (1906) in part; Robinson & Fernald in Gray, Man. ed. 7, 438 (1908); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rollins in Res. Stud. State Coll. Wash. **4:** 14 (1936) in part. *A. ovata* (Pursh) Poir. sensu Rydb., Fl. Colo. 165 (1906); Fl. Rky. Mts. 359 (1918) in part; Fl. Pr. Pl. N. Am. 381 (1932); Wooton & Standley in Contrib. U. S. Nat. Herb. **19:** 280 (1915); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Small, Man. Se. Flora 571 (1933), wrongly attributed to Michx. *A. hirsuta*, f. *banffica* Tuzson in Bericht Frei. Ver. Syst. Bot. for 1919: 41 (1921). *A. hirsuta*, f. *constrictoides* Tuzson, ibid. *A. hirsuta*, f. *cordata* sensu Tuzson, ibid. *A. hirsuta*, f. *crepidifolia* Tuzson, ibid. *A. hirsuta*, f. *gracilis* Tuzson, ibid., p. 42. *A. hirsuta*, f. *iowensis* Tuzson, ibid. *A. hirsuta*, f. *laevis* Tuzson, ibid. p. 43. *A. hirsuta*, f. *novomexicana* Tuzson, ibid. *A. hirsuta*, f. *sagittata* sensu Tuzson, ibid. *A. pycnocarpa*, var. *reducta* Hopkins in Rhodora **39:** 117 (1937), based upon a pathological monstrosity.—Widespread from Quebec to Missouri, Arizona, British Columbia and Yukon.

A detailed discussion of leading characters, geographical distribution, and citations of specimens is given by Hopkins, l. c. under *A. pycnocarpa*, var. *typica* and need not be repeated in the present paper.

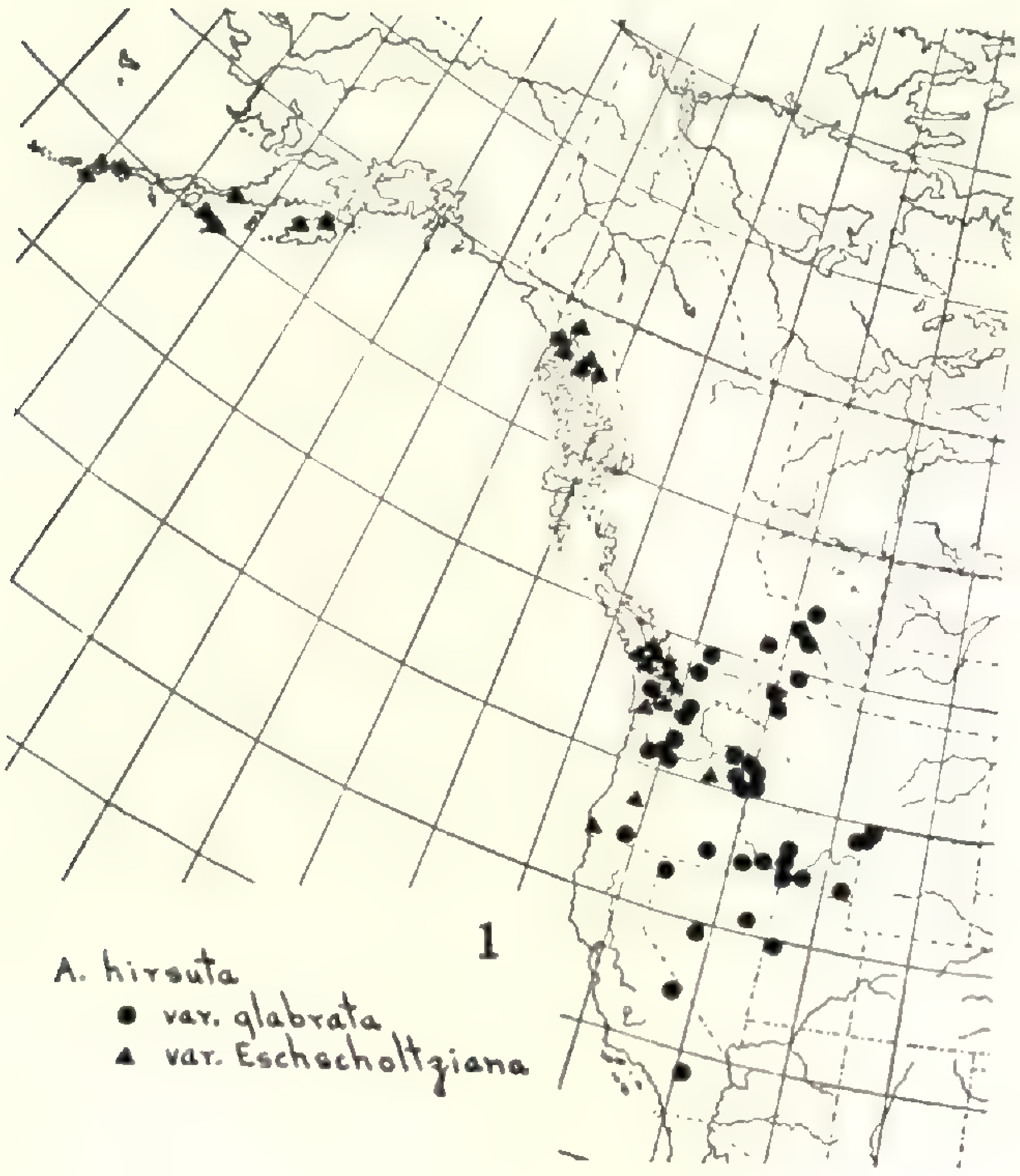
2b. Var. **adpressipilis** (Hopkins), comb. nov. *A. pycnocarpa* Hopkins, var. *adpressipilis* Hopkins in RHODORA **39:** 117 (1937); Deam, Fl. Indiana 506 (1940).

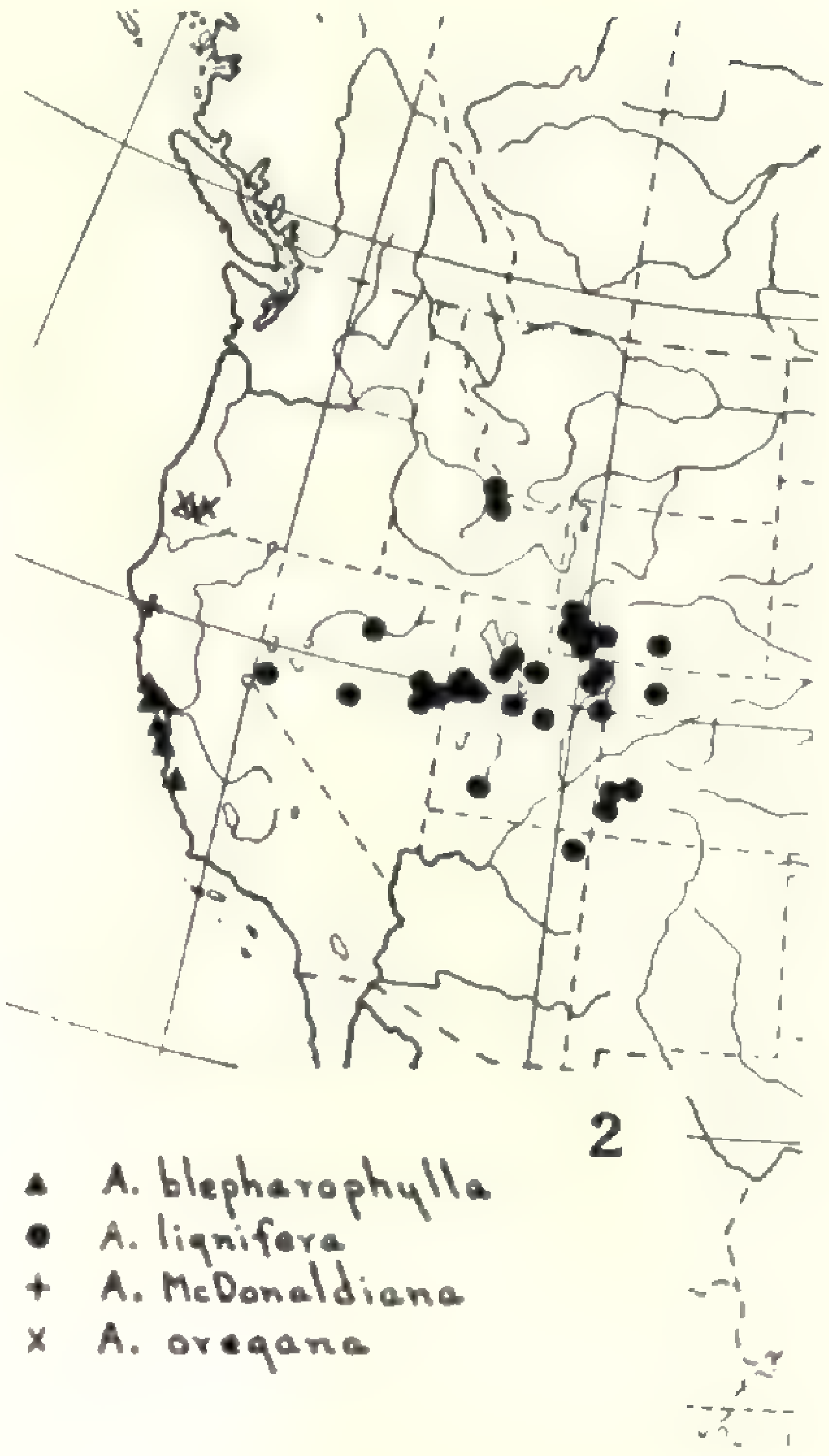
This variety is outside the area included in the present study, but its status has been verified, hence it is transferred to its proper place under *A. hirsuta*. A map showing the distribution of var. *adpressipilis* in the central United States may be seen in Hopkins paper cited above.

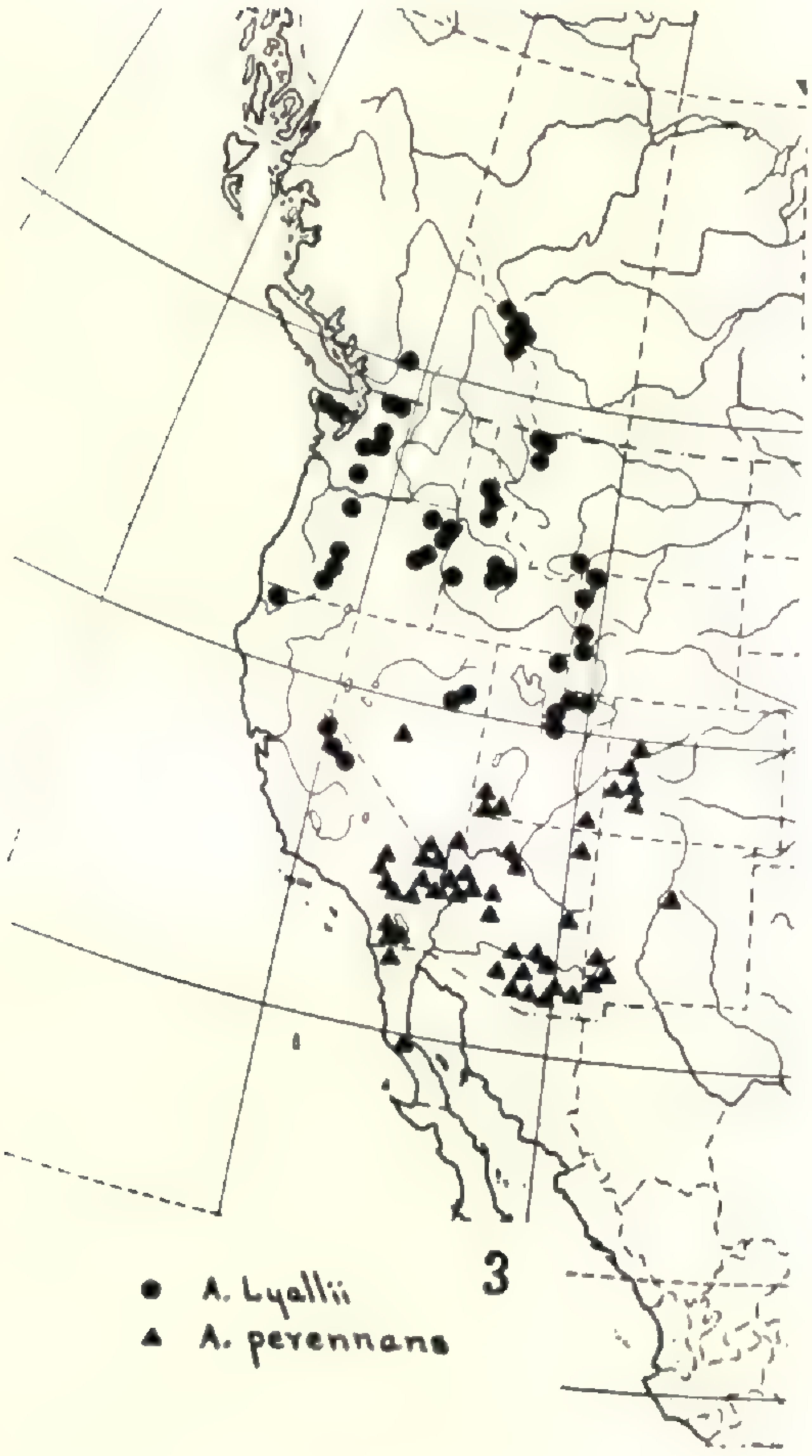
2c. Var. GLABRATA T. & G. Stems hirsute below, glabrous above; basal leaves obovate to oblanceolate, entire or rarely few-toothed, obtuse, sparsely hirsute to nearly glabrous, 3–7 cm. long, 1–2.5 cm. wide; cauline leaves obovate to oblong, rarely ovate, entire to rarely few-toothed; pedicels usually divaricately ascending; petals white, spatulate, 5–9 mm. long; siliques erect to slightly divaricate, usually not appressed, about 1 mm. wide.—*A. hirsuta*, *β glabrata* T. & G., Fl. N. Am. **1:** 80 (1838), not *A. hirsuta*, var. *glabrata* Döll (1862). *A. rupestris* Nuttall in T. & G., op. cit. p. 81; Rydberg, Fl. Rky. Mts. 359 (1917) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925) in part. *Turritis spathulata* Nuttall in T. & G., op. cit. p. 78. *Arabis hirsuta* sensu Watson in Gray, Syn. Fl. N. Am. **1:** 162 (1895) in part; Howell, Fl. Northw. Am. **1:** 42 (1897) in part; Piper in Contrib. U. S. Nat. Herb. **11:** 293 (1906) in part; Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909) in part; Jepson, Man. Fl. Pl. Calif. 428 (1925) and Fl. Calif. **2:** 61 (1936); Munz, Man. So. Calif. Bot. 204 (1935); Rollins in Res. Stud. State Coll. Wash. **4:** 14 (1936) in part. *A. hirsuta*, f. *americana* Tuzson in Bericht. Frei. Ver. Syst. Bot. for 1919, 41 (1921). *A. hirsuta*, f. *integra* Tuzson, ibid. p. 42. *A. pycnocarpa* Hopkins, var. *glabrata* (T. & G.) Hopkins in RHODORA **39:** 116 (1937) in part.—Alberta and British Columbia to Wyoming, Utah and California. MAP 1. ALBERTA: Kootenai Plains, north branch Saskatchewan River, June, 1908, *Brown 951* (G); June, 1908, *Brown 940* (G). WYOMING: Silver Gate, Yellowstone Nat. Park, June, 1885, *Tweedy 556* (US). IDAHO: near Hatwai Cr., Nez Perce Co., April, 1892, *Sandberg et al. 41* (G, isotype of *A. hirsuta*, f. *americana*); near Pollock, Idaho Co., May, 1937, *Constance 1856* (R); Silver City, Owyhee Co., June, 1911, *Macbride 991* (Cl, G, RM); near St. Anthony, June, 1919, *Quayle 58* (Cl, RM); Preston, May, 1909, *M. P. Henderson 48* (RM);

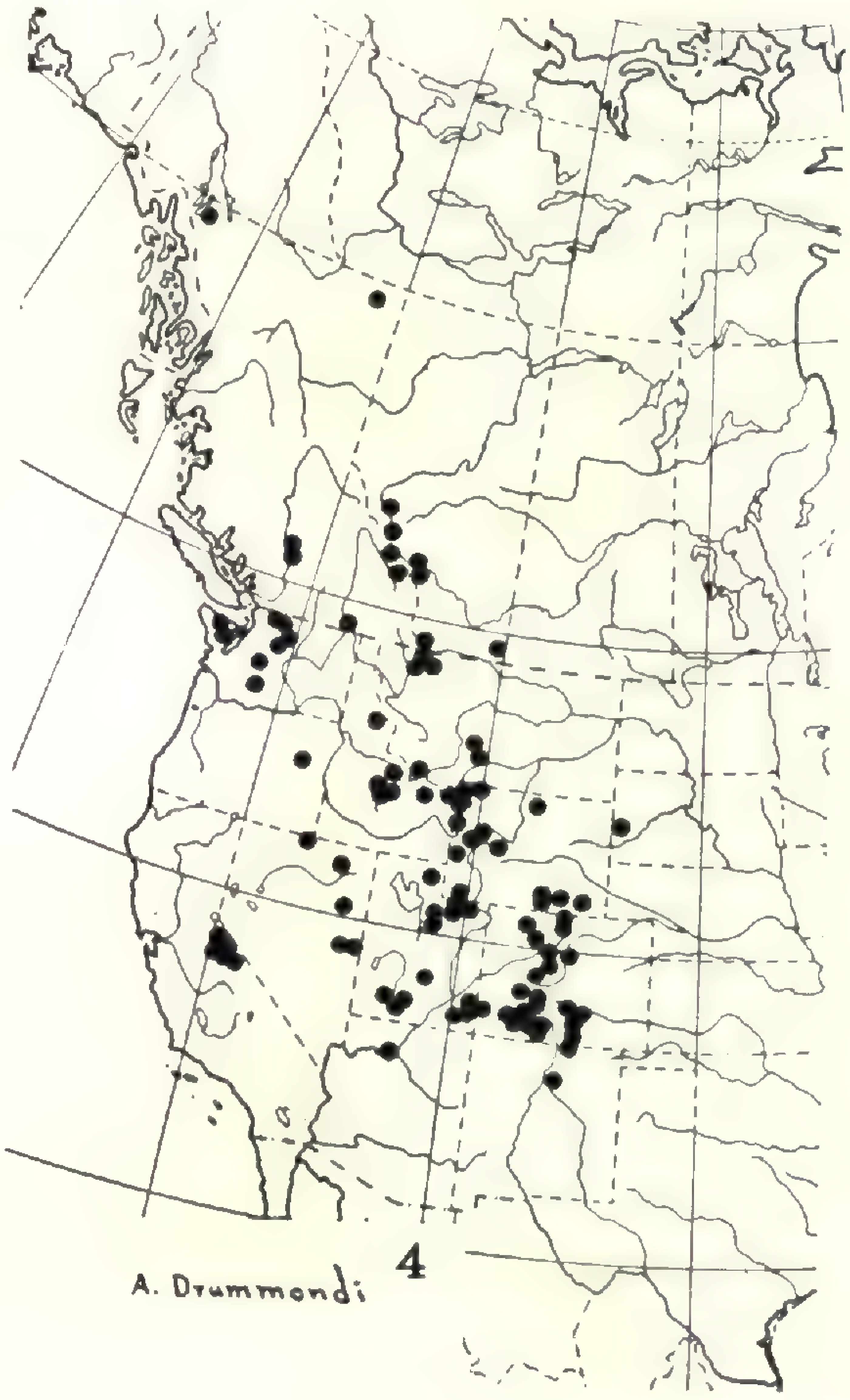
Hope, May, 1914, *Dunkle 412* (RM); Twin Falls-Shoshone Falls, July, 1911, *Nelson & Macbride 1352* (RM). Utah: Deep Creek Mts., June, 1933, *Maguire & Becraft 2627* (R, RM, UAC); Troutcreek, Juab Co., June, 1933, *Maguire & Becraft 2628a* (G, RM, UAC). Nevada: Lamoille Canyon, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2564* (G, R); about 10 miles south of Austin, Lander Co., June, 1937, *Goodner & Henning 117* (NA, R); 2 miles west of Uya, Washoe Co., May, 1939, *Train 2834* (NA, R). California: Cottonwood Creek, White Mts., Mono Co., July, 1891, *Coville & Funston 1807* (G, US); Santa Ana River, San Bernardino Mts., Aug., 1922, *Munz 6324* (G, RM); July, 1926, *Munz 10797* (G); Bear Valley, San Bernardino Mts., June, 1922, *Munz 5728* (RM); Mill Creek Falls, San Bernardino Mts., June, 1901, *S. B. Parish 5069* (G). Oregon: near Cornucopia, Baker Co., July, 1936, *Thompson 13313* (G); Multnomah Falls Trail, Multnomah Co., May, 1940, *Beetle & Constance 2623* (R); Willamette River, *Nuttall s.n.* (G, isotype of *A. rupestris*); Elk Rock, June, 1917, *J. C. Nelson 1269* (G); Ashland-Klamath Falls, July, 1920, *Peck 9228* (G, NY); Ice Lake Trail, Wallowa Mts., June, 1936, *Eastwood & Howell 3310* (R); Steens Mts., July, 1896, *Leiberg 2469* (US). Washington: Winchester Mt., Whatcom Co., July, 1937, *Muencher 7879* (G); upper valley of Nisqually Glacier, Mount Rainier, June, 1894, *Allen 313a* (G); White River, Mt. Rainier, June, 1937, *G. N. Jones 9957* (G); Swauk River, Kittitas Co., 1913, *Sharples 87, 88 & 93* (G); Waitsburg, May, 1897, *R. M. Horner s.n.* (G); Cape Horn, Skamania Co., Aug., 1894, *Suksdorf 2355* (G); Constance Ridge, Olympic Mts., May, 1931, *Thompson 6560* (G). British Columbia: Avalanche Patti, June, 1904, *Shaw 37* (G, isotype of *A. hirsuta*, f. *integra*); Emerald Lake, June, 1931, *Pease 22383* (G); Ainsworth near Kootanie Lake, July, 1890, *J. Macoun s.n.* (G); Glacier, June, 1906, *Brown 291* (G); Lower Frazer River, 1859, *Lyall s.n.* (G); near Lake Bootahnie, Marble Mts., June, 1938, *J. W. & E. Thompson 134* (G).

2d. Var. **Eschscholtziana** (Andrz.), comb. nov. Stems hirsute from base to the inflorescence with spreading simple or forked trichomes; basal leaves obovate to oblanceolate, repand to coarsely dentate, rarely entire, pubescent on both surfaces with coarse trichomes, 3–8 cm. long, 1.5–3 cm. wide; cauline leaves ovate to oblong, auriculate, acute or rarely obtuse, dentate, 1.5–5 (–7) cm. long, pubescent; petals white to pinkish, 5–10 mm. long; mature siliques erect to slightly spreading, 1.5–2.5 mm. wide; stigma usually noticeably bifid.—*A. Eschscholtziana* Andrz. in Ledeb., Fl. Alt. **3:** 25 (1831). *A. hirsuta* sensu Cham. & Schlecht. in Linnaea **1:** 15 (1826); Hooker, Fl. Bor.-Am. **1:** 42









Rollins on Arabis

(1829) in part; Ledeb., Fl. Ross. **3:** 118 (1842); Howell, Fl. Northw. Am. **1:** 42 (1897) in part; Piper in Contrib. U. S. Nat. Herb. **11:** 293 (1906) in part; Piper & Beattie, Fl. Northw. Coast 170 (1915) in part; Henry, Fl. So. Brit. Columb. 150 (1918) in part; Rollins in Res. Stud. State Coll. Wash. **4:** 14 (1936) in part. *A. hirsuta,* f. *Eschscholtziana* (Andrz.) Tuzson in Bericht. Frei. Ver. Syst. Bot. for 1919. 42 (1921). *A. hirsuta,* f. *grandiflora* Tuzson, ibid. *A. hirsuta,* f. *Krausei* Tuzson, ibid. p. 43. *A. hirsuta,* f. *lilacina* Tuzson, ibid. *A. hirsuta,* f. *subsetosa* Tuzson, ibid. p. 44. *A. Stelleri,* var. *Eschscholtziana* (Andrz.) Busch, Fl. Sib. & Orient. Ext. **4:** fam. 25. 438 (1926). *A. rupestris* sensu Hultén, Fl. Aleut. Is. 203 (1937).—Oregon to Alaska. Map 1. Oregon: without locality, 1871, *E. Hall 33* (G); Harbor, Curry Co., June, 1919, *Peck 8737* (G, M); Kamela, Union Co., July, 1915, *Peck 2715* (G); Pauline Lake, July, 1894, *Leiberg 580* (G). Washington: near Fairhaven, Whatcom Co., July, 1890, *Suksdorf 1907* (G, R); Brown Island, near Friday Harbor, May, 1936, *Blanchard 29* (R, UC); near Dewatto, Kitsap Co., May, 1936, *Eicher 78* (G, R, WSC); Colonial Bob Mt., Grays Harbor Co., July, 1934, *Hodgdon & Rossbach 1 & 2* (G); mouth of Skagit River, Skagit Co., May, 1927, *Lucile Roush s.n.* (R); Semiahmoo Bay, 1858, *Lyall* (G). British Columbia: Vancouver Island: San Juan Harbor, Aug., 1907, *Rosendahl 2061* (G); District of Renfrew, 1901, *Rosendahl & Brand 12* (G, RM); Cameron Lake, May, 1917, *W. R. Carter s.n.* (G); Manoose Bay, May, 1916, *W. R. Carter s.n.* (G). Alaska: Taku Harbor, June, 1899, *Coville & Kearney 485* (G); near Skagway, June, 1906, *G. C. Deane, s.n.* (G); mouth of Yes Bay, *T. Howell 1608* (NY); Khantaak Island near Yakutat Bay, June, 1892, *Funston 15* (G); Admiralty Island, June, 1915, *Walker 723* (G); near Karluk, Kodiak Is., June, 1903, *Rutter 28* (G); Larson Bay, Kodiak Is., 1933, *Geist s.n.* (L); Olga Bay, Kodiak Is., June, 1938, *E. H. & H. B. Looff 647 & 648* (G, R); Dutch Harbor, Unalaska, 1907, *Van Dyke 12 & 113* (G), *Hultén 7651 & 5500* (L); Shumagin Islands, Popoff Is., June, 1892, *Harrington s.n.* (G), *Hultén 7708* (L); Chiachi Islands, June, 1874, *Dall s.n.* (G).

The studies of Tuzson[1] on the geographical distribution of *A. hirsuta* significantly show that the species with its multiplicity of forms extends interruptedly around the globe in the northern hemisphere. He gives the limits of occurrence as 38° to 65° north latitude, but the southern limit must be modified in North America to 35°, since the species has been found at about that

[1] Bericht. Frei. Ver. Syst. Bot. for 1919.

latitude in Arizona and New Mexico. In all, according to Tuzson, over 25 species with numerous varieties have been described which really belong in *A. hirsuta.* Accordingly he has relegated many previously described variants to the rank of form and described a number of new forms, particularly from North America. Authentic material of twelve of the sixteen forms attributed to this continent has been studied, with the conclusion that too little material was taken into account when these forms were erected. Tuzson did not set up natural entities, consequently his names have been placed in synonymy under the three varieties of *A. hirsuta* in which they seem to belong.

In treating *A. hirsuta* for North America, it appears that phylogeny is best served by the maintenance of the principal natural entities as varieties rather than as species, since treating them as species tends to obscure the very close relationship which exists between them. Actually there is a certain amount of intergrading between these entities and if they could not be correlated with geographic areas, their continuation even as varieties might be seriously challenged. Hopkins[1] has described the American plants as a new species, separating them from the Eurasian *A. hirsuta.* In doing so he has emphasized the strongest divergences detectable without, it seems to me, giving adequate consideration to the entire natural variation occurring in plants of either Eurasia or America. Unfortunately, each character emphasized as distinguishing *A. pycnocarpa* from *A. hirsuta* is found to be variable and breaks down as a valid point of distinction when systematically tested on a large series of either American or European plants. This is particularly true when vars. *Eschscholtziana* and *glabrata* are taken into consideration, but was freely found to be the case with populations of var. *pycnocarpa* studied in the field in the Rocky Mountain area.

The distribution of *A. hirsuta* in a general way parallels that of *A. glabra* and it is not disturbing from the geographical point of view to find it widely distributed in both the eastern and western hemispheres. It is true that the American plants show certain tendencies away from the characteristics found in plants of Eurasia, but the resulting differences are by no means

[1] Rhodora **39**: 112 (1937).

of a specific nature. It appears that two alternative courses are open to one treating *A. hirsuta* for North America. The species may be divided into ten or a dozen "microspecies" which do not parallel in the slightest other species of the genus or it may be kept intact as a wide-spread species with the principal variants designated as varieties. Using the more clearly defined species of *Arabis* as a guide as to where specific lines should be drawn in those where complexity often obscures natural boundaries, it is clear that the latter course is preferable.

The application of the name *Turritis ovata* Pursh to an American species of *Arabis*, as shown by Hopkins, l. c., remains unsolved. DeCandolle, l. c., indirectly, and Torrey and Gray, l. c., directly used Pursh's name in a varietal category and this name should have priority over var. *pycnocarpa* if its suspected application could be proved. Under the circumstances it seems best to base the varietal name on plants which are adequately described and represented by a known type. Variety *pycnocarpa* is well illustrated and mapped by Hopkins, l. c., under *A. pycnocarpa*, var. *typica*. A few minor range extensions could be given for the Rocky Mountain region, but this seems hardly necessary since the variety is known to occur widely in the area. Plants of var. *pycnocarpa* have been grown in the greenhouse for three consecutive years without their having flowered. This would seem to indicate that it is often a perennial instead of a strict biennial as formerly supposed.

Var. *Eschscholtziana* was described from specimens collected on the island of Unalaska by Chamisso. The type has not been examined, but there is little doubt as to the identity of the plants. The only other *Arabis* reported from Unalaska is the very different *A. lyrata*, var. *kamchatica*. Var. *Eschscholtziana* is apparently abundant on lower mountain slopes and cliffs at a number of stations from the Aleutian Islands of Alaska to southern Oregon, chiefly near the ocean. The basal leaves of this variety are often large, thick and purplish on the under surface. It intergrades to some extent with var. *glabrata*, but in general the two are distinguishable and occupy separate geographical areas.

Var. *glabrata* was based on a specimen collected in Oregon by Dr. Scouler, but the actual type has either been misplaced

or lost. The application of the name to the nearly glabrous-leaved plants from Oregon, Washington, Idaho, British Columbia and nearby areas seems to be sound. Our interpretation differs from that of Hopkins in that we limit var. *glabrata* to the large-flowered plants with diverging pedicels and somewhat saccate outer sepals from the northwestern United States and adjacent Canada. The nearly glabrous types from the Rocky Mountains and farther east do not differ enough from typical var. *pycnocarpa* to be set off from it.

In accounting for *A. pycnocarpa*, var. *reducta*, it may be pointed out that this is the fifth entity described in *Arabis* from North America based on specimens with sterile, semi-sterile or diseased siliques. Partial or complete sterility is a fairly common phenomenon in *Arabis* and has been repeatedly observed in the field in widely separated places. The distinctive characteristics claimed for var. *reducta* are attributable in a large part, particularly in the type specimen, to the diseased siliques, which have only a powdery brown mass in place of normal seeds. The name is considered to have been based on a monstrosity, hence it does not have valid priority over var. *pycnocarpa*.

(*To be continued*)

A STUDY OF ARENARIA PATULA

JULIAN A. STEYERMARK

ONE of the most characteristic spring-flowering species which carpets the limestone glades and barrens of the Missouri Ozarks is the little annual species of sandwort, *Arenaria patula* Michx. Its numerous dainty white blossoms appear in April and May, covering thousands of square miles of rocky surface, and so densely are the areas covered that they suggest natural rock gardens. By June the seed is ripened and the plant dies after this brief three-months' span of activity.

While collecting in the spring of 1939 in an area on Crowley's Ridge adjacent to the lowlands of southeastern Missouri, the writer found plants of this species growing in open sandy ground, a habitat quite unlike the rocky glades and outcrops in other portions of the state. Moreover, all the plants observed were of

a very luxuriant type with larger, broader leaves and taller, stouter stems with greatly elongated internodes, giving a different aspect from the usual slender-leaved and -stemmed phases of this species. Subsequent examination of the collection from this area, together with an investigation of the variation of the species as a whole, brought out the fact that the group passing under the name of *Arenaria patula* was in need of further study. The purpose of the present paper, therefore, is to delimit the variation found within this species.

In 1803 Michaux[1] described *Arenaria patula* from a plant collected "circa Knoxville" which was "tota puberula". Specimens collected by Dr. Short in Kentucky were later cited by Torrey and Gray[2] as representing Michaux's species; the reference by them to Professor Ruffner's collection from the mountains of Virginia was a mistaken determination and referred to another plant. Although Michaux described his plant as "puberula", actually there are no non-glandular hairs in any collections of the species. Torrey and Gray state in their description that the stems are "glandular-pubescent under a lens". On the same page of the Flora of North America, Torrey and Gray[3] described another species, *A. Pitcheri*, taken from Nuttall's mss., collected by Nuttall from "plains of Arkansas". This species was noted at the time to differ from *A. patula* principally in its glabrous stems. In the Synoptical Flora of North America,[4] however, Robinson reduced outright several species, including *Arenaria Pitcheri* Nutt., to synonymy under the earlier described *Arenaria patula* Michx. In passing, Robinson[5] states only that "the leaves of this species are variable, more often narrowly linear or filiform, 4 to 7 lines in length, but occasionally 1½ inches long and a line wide." The more significant variation of glandularity versus glabrity Robinson did not consider, viewing his species-concept of *A. patula* as a puberulent group together with *A. tenella* Nutt. of the northwestern United States as contrasted to the glabrous *A. stricta* Michx. and var. *texana* Rob. In this concept Robinson was followed by all subsequent authors, and the whole question of

[1] Michaux, A. Fl. Bor.-Am. 1: 273. 1803.
[2] Torrey, J. and A. Gray, Fl. N. Am. 1: 180. 1838.
[3] Ibid.
[4] Robinson in Gray, Syn. Fl. N. Am. 1[1]: 245. 1895–97.
[5] Ibid.

variation within the species seems to have been ignored, except for notes made from time to time by some collectors when exceptionally glandular specimens were encountered.

From a study of many specimens, it is evident that the variability of the species is more than might appear at a first glance. In addition to the glabrity or glandularity, are found other differences, such as width of leaves, length of internodes, and length, ribbing, and glabrity of the sepals. Mature seeds of a number of specimens were examined for critical characters, but no distinctive differences were encountered. The majority of the plants of *Arenaria patula* in the Missouri Ozarks and the limestone hills of Alabama are characterized by their almost complete glabrity, typical of Nuttall's *Arenaria Pitcheri* from "plains of Arkansas". Especially in the northeastern area of dispersal of the species, the stems and pedicels show an abundance of glandularity, while to the south and especially in low sandy Tertiary soils are luxuriant robust types of plants with much broader leaves. While the extremes of these types of variation appear to be quite distinct, too many intergradations exist which break down between the groups. This, together with the occurrence of the variations mostly scattered throughout the entire area of distribution and without any real, definite geographical ranges, indicates that the variations are best regarded as forms rather than as varieties.

In the study of this species the author has had the privilege of the examination of material from the following herbaria: Herbarium of the Field Museum of Natural History (F), Gray Herbarium of Harvard University (G), Missouri Botanical Garden (M), the Academy of Natural Sciences of Philadelphia (P) and the University of Tennessee (T). To the curators of these herbaria the writer is deeply appreciative for their courtesy in loaning the material. To Mr. C. A. Weatherby the writer is greatly indebted for valuable suggestions.

Leaves mostly 2–3.2 mm. broad, as much as 3.5–5.2 cm. long .... *A. patula* f. *robusta.*
Leaves 0.5–1.5 mm. broad.
  Sepals wholly glabrous; stems, pedicels, and leaves mostly entirely glabrous .... *A. patula* f. *Pitcheri.*
  Sepals densely to lightly glandular; stems pedicels, or (and) leaves glabrous to glandular.

Sepals, pedicels, leaves, and stems densely glandular .... *A. patula.*
Sepals, and pedicels slightly to densely glandular; leaves and stems mostly glabrous .... *A. patula* f. *media.*

Arenaria patula Michx. Fl. Bor. Am. **1:** 273. 1803; Torr. & Gray, Fl. N. Am. **1:** 180. 1838; Robinson in Gray, Syn. Fl. N. Am. **1**[1]**:** 245. 1895–97; Rob. & Fern. in Gray, Man. 7th ed. 380. 1908; Britton & Brown, Ill. Fl. ed. 2. **2:** 56. 1913. *Alsine patula* Gray, Man. ed. 2. 58. 1856; Chapman, Fl. Southern U. S. 49. 1860. *Alsinopsis patula* (Michx.) Small, Fl. Se. U. S. ed. 2. 420. 1913. *Sabulina patula* (Michx.) Small, Man. Se. Flora. 499. 1933.

Stems 7–27 cm. tall, simple or branched from below and at the middle, slender, 0.5–0.9 mm. in diameter, the internodes not especially elongated, usually densely glandular with long-stalked glandular hairs up to 0.5–0.8 mm. long, the internodes 0.8–3.5 cm. long; leaves averaging short and slender, 0.8–2.5 cm. long, 0.8–1 mm. broad, sparsely to moderately glandular; inflorescence much branched, the pedicels filiform, sparsely to densely glandular, especially abundant at base of pedicel and at tip below the flower; sepals 4.5–6 mm. long, 0.8–1.5 mm. broad, 3–5-ribbed, the ribs usually conspicuous but separated, moderately to densely glandular, the inner sepals conspicuously scarious; petals 7–9 mm. long, 2.5–3 mm. exceeding the tips of the sepals.—Distributed in Ohio, Indiana, Illinois, Kentucky, Tennessee, and locally in eastern Oklahoma. This form is commonest in the northeastern part of the range of the species. It is the only form of the species found in Ohio and Indiana.—Ohio: Dayton, June 3, 1898, *Moseley* (F). Indiana: Lafayette, May, 1877, *A. H. Young* (M); about 4 miles southwest of Lafayette, Tippecanoe Co., *Deam 51943* (F). Kentucky: vicinity of Mammoth Cave, Edmonson Co., May, 1899, *Dr. E. Palmer* (G). Tennessee: deep in moist woods loam, Paint Rock bluff of French Broad River, 1¼ mi. beyond Marbledale, Knox Co., April 19, 1938, *Jennison 97* (T). Illinois: limestone ledges, South Chicago, July 12, 1875, *Hill* (G); Mound, Joliet, June 11, 1881, *Boyce* (F). Oklahoma: Limestone Gap, April 16, 1877, *Butler 3* (M), and *79* (F); 10 miles north of Limestone Gap, April 21, 1877, *Butler 11002* (F M,).

Most of the specimens cited above have more or less dense glandularity on the stems, leaves, pedicels, and sepals. *Jennison 97* from near the type locality in Knox County, Tennessee, is somewhat intermediate between typical *A. patula* and forma *media* since the leaves and sepals are only slightly glandular to glabrate, while the stems and pedicels are more or less densely glandular. *Deam 51943* from Indiana is glandular on all parts of

the plant and may be considered as the type of plant Michaux collected around Knoxville when he described his plant as "tota puberula". Of all the specimens I have examined from Tennessee in the vicinity of the type locality, there is none which is as densely glandular throughout as is *Deam 51943* and most of the other specimens cited above; the nearest approach in Tennessee to a densely glandular plant is the one collected by Jennison (no. 97) in Knox County.

A. PATULA forma **Pitcheri** (Nutt.), comb. nov. *A. Pitcheri* Nutt. ex Torr. & Gray, Fl. N. Am. **1:** 180. 1838.—Plants usually of smaller stature and with shorter more slender leaves; stems 6–25 cm. tall, usually simple below, mostly slender and wiry, 0.2–1 mm. in diameter, the internodes usually short, those near the base of the stem the shortest, 0.5–4 cm. long, completely glabrous or practically so; main cauline leaves smallest at and near the base of the plant, 0.6–2.5 cm. long, 0.4–1 mm. broad, glabrous; inflorescence usually short and little-branched, the pedicels filiform, glabrous or rarely sparsely minutely glandular near base of pedicel or at tip below the flower; sepals usually 5-ribbed, usually conspicuously so with the ribs closer together than in the other forms, somewhat scarious, especially on the inner sepals, but less so than in any of the other forms, linear-lanceolate, acuminate with a longer more sharply pointed tip than in the other forms, 3.5–7 mm. long, 0.8–1.3 mm. broad, glabrous throughout; petals 6–9 mm. long, 2–3.5 mm. exceeding the tips of the sepals.—Kentucky, Tennessee, Alabama, Missouri, Arkansas, Kansas, Oklahoma, and Texas. Commonest on the limestone barrens of the Ozarks of Missouri and on the chalk barrens of Alabama.—KENTUCKY: "Torr. & Gray, Fl. N. Am., ex herb. *George Thurber*" (G); *Curtis* (M). TENNESSEE: Laverne, *Smith* (F); Nashville, April, 1878, *Gattinger* (F). ALABAMA: limestone hills, Huntsville, April 28, 1883, *Mohr* (G); Lawrence Co., 1866, *Peters* (G); gneiss outcrops near Coosa River between Mitchell Dam and Knight's Ferry, Chilton Co., May 7, 1937, *Harper 3575* (G); Chalk Barrens, about a mile west of Epes, Sumter Co., April 8, 1934, *Harper 3157* (G). MISSOURI: Greene Co., April 30, 1887, *Blankinship* (G); Washington Co., 1884, *Bebb* (G); Independence, May 21, 1894, *Bush 53* (G); Jefferson Co., May 28, 1887, *Eggert* (G); Greenwood, May 10, 1912, *Bush 6667* (G); Allenton, July 5, 1887, *Letterman* (F); Jefferson Co., April 23, 1887, *Hasse* (F); Potosi, Washington Co., June–July, *Pech* (F); Greenwood, Jackson Co., May 9, 1897, *Mackenzie* (F); Highway 66 east, Laclede Co., April 30, 1938, *Geo. Moore* (F); along tributary of South Creek of Gravel River, 3½ mi. east of Lisle, Cass Co., June 2, 1938, *Steyermark 5725* (F); border-

ing Sac River around Percy Cave, 5 mi. NW of Springfield, Greene Co., May 5, 1939, *Steyermark 22110* (F); along Wyatt Creek, sect. 3, 4 mi. east of Lanton, Howell Co., April 27, 1938, *Steyermark 5174* (F); sandstone glade along Sinking Creek, 2½ mi. SW of Everton, Dade Co., May 7, 1939, *Steyermark 22289* (F); 1 mi. northwest of Cabool, Texas Co., June 9, 1939, *Steyermark 26946* (F). Arkansas: Prescott, May, 1884, *Letterman*, in part (F); "*Arenaria Pitcheri" "Arkansas" presented by Elias Durand, 1866, coll. *Nuttall* (G, type collection of *Arenaria Pitcheri*). Kansas: Chautauqua Co., May 7, 1897, *Hitchcock 1010* (G, M). Oklahoma: *Waugh 12* (M); Sapulpa, April 29, 1895, *Bush 901* (M); 1 mi. north of Limestone Gap, May 18, 1877, *Butler 64* (F). Texas: Lindale, April 23, 1901, *Reverchon* (M).

I have seen isotype collections of *Arenaria Pitcheri* Nutt. from Arkansas (specimens in Gray Herb. and Acad. of Nat. Sci. Phila.); these specimens are completely glabrous. Plants collected by Dr. Pitcher from "Arkansas" and cited by Torrey and Gray are also strictly glabrous and are conspecific with the Nuttall specimens. Most of these glabrous forms have been collected from Missouri and Alabama, whereas Arkansas has yielded fewer collections of this glabrous form in recent years than of *A. patula* f. *media*. The completely glabrous habit combined with conspicuously 5-ribbed acuminate narrow sepals in which the ribs are close together make this form stand out from the more glandular plants with often loosely and inconspicuously ribbed sepals of *A. patula* f. *media*. Yet, several specimens are found which are otherwise glabrous except for a small amount of glandularity on the pedicels, and these break down the distinction. Specimens which exhibit this transition are *Letterman* from Prescott, Arkansas (Field Mus. Herb.), and *Peters* from Lawrence Co., Alabama (Gray Herb.).

A. patula forma **robusta,** f. nov., a typo differt caulibus 12–42 cm. altis, glabris vel interdum glandulosis 0.8–1.5 mm. latis, internodiis elongatis 1.3–8.5 cm. longis; foliis caulinis 1.5–5.2 cm. longis, 1.5–3.2 mm. latis, glabris; pedicellis parce glandulosis vel fere glabris; sepalis plerumque 3-costatis scariosis subacutis glandulosis vel fere glabris, 3–4.5 mm. longis, 1–1.5 mm. latis. Missouri: open sandy ground in open woods along Gillis Bluff, sect. 8 and 17, 5 mi. southwest of Quilin, Butler Co., May 27, 1939, *J. A. Steyermark 26652* (type, in Herb. Field Mus.).

Stems 12–42 cm. tall, remaining mostly simple below and up to the flowering portion, mostly glabrous or occasionally with

scattered glandularity, 0.8–1.5 mm. broad, the internodes usually greatly elongated, especially the middle and upper ones, 1.3–8.5 cm. long, those just below the first branch of the inflorescence usually 3–8.5 cm. long, mostly glabrous; main cauline leaves smallest at the base of the plant, increasing in length upwards, 1.5–5.2 cm. long, 1.5–3.2 mm. broad, glabrous; inflorescence moderately branched with elongated pedicels, the pedicels usually sparsely glandular or sometimes almost glabrous; sepals usually 3-ribbed, the ribs conspicuous but well separated, both inner and outer sepals scarious, tips of sepals slightly less acute at summit, usually sparsely to moderately glandular or almost smooth, 3–4.5 mm. long, 1–1.5 mm. broad; petals 7–9.5 mm. long, 3.5–6 mm. exceeding the tips of the sepals.—Tennessee, Missouri, Kansas, Arkansas, and Texas.—TENNESSEE: West Nashville, May 26–27, 1909, *Eggleston 4431* (G). MISSOURI: 5 miles southwest of Quilin, Butler Co., May 27, 1939, *Steyermark 26652* (TYPE in F, ISOTYPES in G and M). ARKANSAS: Grand Prairie, about a mile west of Screeton, Prairie Co., May 1, 1923, *Harper 28* (G); Prescott, May, 1884, *Letterman*, in part (G); near Hazen, Grand Prairie, May 22, 1924, *H. E. Wheeler 84* (F). KANSAS: Miami Co., May 26, 1883, *Oyster* (F). TEXAS: 2½ miles east of New Boston, Bowie Co., May 20, 1937, *Cory 22962* (G); Paris, April 10, 1904, *Reverchon 4285* (G, M); 1845, *Wright* (G).

This form is rather rare and occurs scattered throughout the southern portion of the range of the species. Some specimens of this form are not easily separated from the species. For example, *E. J. Palmer 5543* and *H. E. Wheeler 84* approach this form in size of plant, but have the narrower leaf-blades of typical *A. patula*. A specimen collected by Oyster from Miami Co., Kansas and *Harper 28* from Arkansas are transitional between this form and *A. patula* f. *media*.

A. PATULA forma **media,** f. nov., a typo differt caulibus plerumque glabris vel supra minute glandulosis; foliis 0.8–2.7 cm. longis, 0.5–1.5 mm. latis, glabris vel parce glandulosis; sepalis scariosis 3–7 mm. longis, 0.8–1.25 mm. latis, costis plerumque conspicuis confertis, glabris vel parce glandulosis.—TENNESSEE: rocky glades near Nashville, May, *Gattinger* (Type in Herb. Field Mus., isotypes at G, M).

Stems 10–30 cm. tall, simple below or branched from the middle, slender, 0.5–1 mm. in diameter, the internodes rather elongated, the lower usually glabrous, the middle and upper glabrous to minutely glandular, the internodes below the inflorescence 1.5–5 cm. long, those just below the first branch of the inflorescence usually 3–5.5 cm. long, the lower ones shorter, the glandularity confined mostly to the lower part of the inter-

nodes; main cauline leaves smallest at the base of the plant, increasing in length upwards, 0.8–2.7 cm. long, 0.5–1.5 mm. broad, glabrous to sparsely glandular; inflorescence usually much branched, the pedicels filiform, elongate, usually sparsely or moderately glandular especially at base of pedicel and near tip just below flower, or glabrous; sepals 3- to 5-ribbed, scarious, especially the inner ones, 3–7 mm. long, 0.8–1.25 mm. broad, the ribs conspicuous, close, and elevated, or inconspicuous, separated and depressed, glabrous to slightly glandular; petals 6.5–9 mm. long, 2.5–5 mm. exceeding the tips of the sepals.—Kentucky, Tennessee, Alabama, Illinois, Missouri, Arkansas, Oklahoma, and Texas. Kentucky: Summit of the calcareous cliffs of the Kentucky (River), *Griswold* (G); Henry Mt., Irvine, Estill Co., May 25, 1927, *W. A. Anderson 506* (G); cliffs of Kentucky River, 1835, *Short* (G), and 1840, *Short* (M); Lexington, May 19, 1882, herb. Wm. Dunham (F); Cliffs of Kentucky River, High Bridge, May 13, 1923, *Mc Farland 21* (M); Bowling Green, May, 1896, *Price* (M). Tennessee: near Nashville, May 12, 1903, *Ruth 391* (G); 5 mi. south of Murfreesboro, Rutherford Co., April 24, 1936, *Svenson 7761* (G, T); Lebanon, Wilson Co., May 23, 1934, *Harger 7916* (G); vicinity of Nashville, *Gattinger* (G); rocky glades near Nashville, May, *Gattinger* (F, G, M), and May, 1879, *Gattinger* (F, M); Nashville, May 14–17, 1894, *Bicknell* (F); dry woods, Loyston, Union Co., May 27, 1934, *Rice* (T); dry woods, Sequoia Hills, Knoxville, Knox Co., May 4, 1937, *W. B. Drew, S. V. Drew, and Hesler 412* (T); cedar barrens near Mascot, Knox Co., May 10, 1936, *J. K. Underwood* (T); cedar glades, along Nashville road near Lavergne, Davidson Co., June 2, 1938, *Svenson 8707* (T); open abandoned field, near Nashville, Davidson Co., April 20, 1940, *Shanks and Sharp 455* (T); rocky pasture, near Norris, Anderson Co., April 25, 1940, *Cole, Jr. 490* (T); on rocky limestone soil near Lebanon, Wilson Co., April 19, 1940, *Shanks and Sharp 449* (T); cedar barrens near Lavergne, Rutherford Co., April 20, 1940, *Shanks and Sharp 441* (T); rock quarry, Norris, Anderson Co., May 20, 1937, *Varnell* (T); near Lavergne, Rutherford Co., May 4, 1898, *Eggert* (M); *Wilkinson* (G, M). Alabama: Northern Alabama, June, 1865, *Dr. Stewart* (F); Winston Co., May 1, 1881, *Mohr* (F). Illinois: Joliet, May 26, 1864, herb. Wm. Boott (G); barrens, Romeo, May 22, 1897, *Umbach* (F, M); Chicago, *Munroe* (F); 12 mi. from Chicago, June 15 and July 3, 1874, *H. H. Babcock* (G); Kankakee, 1914, *De Selm 791* (F). Missouri: Eagle Rock, June 10, 1897, *Bush 8* (G); upland sandstone glades, 2 mi. sw. of Birdsong, St. Clair Co., June 27, 1939, *Steyermark 27506* (F); St. Louis Co., May 15, 1879, *Letterman* (F); Allenton, May 26, 1886, *Eggert* (F); Allenton, April 30, 1880, *Letterman* (F); Cedar Hill, May 17, 1923, *Kellogg* (M); 1887,

Dr. Hasse (M); Noel, May 5, 1909, *Bush 5618a* (G); Crystal City, Engelm. herb. (M). ARKANSAS: Ulm, Prairie Co., May 9, 1937, *Demaree 14920* (M); Eureka Springs, April 17, 1899, *Trelease* (M); Eureka Springs, May 8, 1899, *Canby 11* (G); east of Mountain Home, Baxter Co., June 8, 1933, *Steyermark 7837* (M); Penters Bluff, Croker Springs, Izard Co., April 16, 1938, *Demaree 17007* (F); Eureka Springs, Carroll Co., May 17, 1914, *E. J. Palmer 5543* (F, M); northwestern slope of Fourche Mt. (Allis Mt.), Pulaski Co., April 26, 1923, *Harper 16* (G); moist prairie, Lonoke, April 25, herb. Warren H. Manning (G); low moist meadows, northwestern Ark., April, *Harvey* (F, G, M); damp meadows, May, 188–, *Harvey*—no. 20 of Harvey's Ark. flora (F). OKLAHOMA: 1 mi. north of Limestone Gap, May 18, 1877, *Butler* (F, M); Catoosa, May 8, 1895, *Bush 966* (M). TEXAS: *Drummond* (G); 32, Hooker misit, *Drummond*, 1835 (G); *Lindheimer*, 1844, 223. Fasc. II. (G, M); Hockley, 1890, *Thurrow* (F), as *Stellaria macropetala.*

This is the common and most widespread variation of *Arenaria patula*. Several specimens appear as intermediates between the more pronounced glandular typical *Arenaria patula* and the glabrous *A. patula* f. *Pitcheri.*

FIELD MUSEUM OF NATURAL HISTORY
Chicago

A NOTE ON THE AUTHORSHIP OF CERTAIN SPECIES OF CYPERACEAE

CHARLES GILLY

WHILE recently using Torrey's "Monograph of North American Cyperaceae" (Annals of the Lyceum of Natural History of New York **3:** 239–443. 1836). I found that five species and two combinations published therein have been rather consistently accredited to the wrong author. In his introduction, Torrey wrote, "Most valuable aid has been afforded me, not only in the communication of specimens, but in every part of this work by my friend Dr. Gray. The revision of the Rhynchosporae is entirely his own; and the Synopsis of North American Carices, I wish to have considered as our joint performance." Again, preceding the genus *Rhynchospora* in the body of the "Monograph", he wrote, "The following revision of the North American species of Rhynchospora and Ceratoschoenus was prepared by Dr. Gray. His valuable Monograph contained in the present

volume of the Annals is so full that it is quite unnecessary to describe the plants anew: I have therefore merely given his list of the species with some alterations, which he has thought it advisable to make, together with some valuable additional matter which has been received since his monograph was written."

The only species of *Rhynchospora* described in this portion of the "Monograph" was *R. filifolia* which in the Index Kewensis and in most manuals, including the recent ones, is assigned to Torrey. It seems clear, from Torrey's own statement, that this species should be cited: *Rhynchospora filifolia* Gray in Torrey, Ann. Lyc. N. Y. **3:** 366. 1836. So far as I have been able to ascertain, Chapman—in the various editions of his "Flora of the Southern United States"—has been the only person to realize Gray's authorship of this species. Two combinations under the generic name *Ceratoschoenus* are assigned to Torrey in the Index Kewensis. Although this genus is no longer upheld—its species being referred to *Rhynchospora*—these two names, whenever they are listed in synonymy, should be cited: *Ceratoschoenus longirostris* (Michx.) Gray in Torrey, Ann. Lyc. N. Y. **3:** 369. 1836; *C. macrostachys* (Torr.) Gray in Torrey, l. c. Gray, in the first four editions of his "Manual of the Botany of the Northern United States", listed the latter species as *Ceratoschoenus macrostachys* Gray, thereby admitting the authorship of the combination; in the fifth edition of his "Manual" he recombined the genus with *Rhynchospora*. Chapman also attributed this species to Gray.

Referring again to the first of the two quotations given above, and then to the treatment of *Carex* in the "Monograph", one finds that four species—in addition to those assigned to Torr. & Hook.—were published there: 39. *C. alata*, 46. *C. Jamesii*, 47. *C. Scouleri*, and 130. *C. turgescens*. These species have been universally accredited to Torrey, but Torrey clearly indicated that they should be cited: *Carex alata* Torr. & Gray in Torrey, Ann. Lyc. N. Y. **3:** 396. 1836; *C. Jamesii* Torr. & Gray in Torrey, l. c. 398 (not *C. Jamesii* Schwein. 1824); *C. Scouleri* Torr. & Gray in Torrey, l. c. 399; *C. turgescens* Torr. & Gray in Torrey, l. c. 419. Both *C. alata* and *C. turgescens* are still recognized as species; *C. Jamesii*, as a later homonym, is a synonym

of *C. nebraskensis* Dewey, and *C. Scouleri* is given as a synonym of *C. Lyngbyei* Hornem. by Mackenzie (N. Am. Fl. **18:** 415. 1935).

New York Botanical Garden, New York, New York

Epilobium paniculatum var. subulatum in Wisconsin.—A single plant of *Epilobium paniculatum* Nutt. var. *subulatum* (Haussk.) Fernald was found by the writer in sandy gravel ballast of a Chicago, Milwaukee, St. Paul and Pacific Railroad siding a half mile north of Lake station, Milwaukee County, August 13, 1940 (specimen in the herbarium of the University of Wisconsin). The specimen is 35 cm. high, freely branching, with flowers 5.5 mm. long, calyces 3.5 mm. long, petals exceeding the calyces by 2 mm., summit of hypanthium and calyx-tube glabrous, capsules (not fully mature) 16–20 mm. long, on slender pedicels 6–8 mm. long, agreeing with descriptions of the far-western variety *subulatum* (*Epilobium subulatum* Rydb.). This is found from Idaho and Utah to California and British Columbia, and as a relic on Bruce Peninsula, Manitoulin Island and Cloche Peninsula, Ontario.[1] Seeds of *Epilobium paniculatum* have been recorded as occurring in 10% of samples of commercial red clover seed grown in Idaho, Washington and Oregon.[2] Its occurrence as an impurity in commercial seed and its appearance as an introduction in Wisconsin furnish an example of a relic plant of disrupted range which also behaves as a weed. This would support the hypothesis recently put forward by Griggs,[3] that relic species may in some cases owe their survival to the fact that they belong to early stages in ecological succession (as do weeds), and that their habitats have not permitted the development of climax formations.—L. H. Shinners, University of Wisconsin, Madison.

[1] Fernald, M. L. Critical plants of the upper Great Lakes region of Ontario and Michigan. Rhodora 37: 324. 1935.

Rydberg, P. A. Flora of the Rocky Mountains and adjacent plains, 2nd ed., p. 589. 1922.

[2] Proc. Internat. Seed Testing Assoc. 6: 1–22. 1928.

[3] Griggs, Robert F. The ecology of rare plants. Bull. Torr. Bot. Club 67: 575–594. 1940.

THE CAMPESTRIAN VARIETY OF FROELICHIA FLORIDANA.—

FROELICHIA FLORIDANA (Nutt.) Moq., var. **campestris** (Small), stat. nov. *F. campestris* Small, Fl. Se. U. S. 397 and 1330 (1903).

I am unable to find what I consider specific characters to separate the plant of the prairies and plains of the interior of the continent from the coastal plain *Froelichia floridana.* In general the two can be distinguished by the rather elliptic-lanceolate leaves of the latter, these tapering from below or near the middle to base and apex, while the principal leaves of var. *campestris* are usually oblanceolate or subspatulate, broadest above the middle and more rounded to tip. In typical *F. floridana*, the well developed large plants have the lowest internode of the primary inflorescence commonly 1–2 dm. long (shorter in small and undeveloped plants), while the fully developed inflorescence of var. *campestris* has the lowest internode usually only 2–10 cm. long. I get no satisfaction out of the characters of pubescence and calyx relied upon by Standley in N. Am. Fl. xxi^2. 127, 128 (1917). His key characters are

"Pubescence on the upper part of the stem of very short, brownish hairs; one or both faces of the calyx-tube with 1 or 2 tuberculate or spinose ridges. . . . . 3. *F. floridana.*
Pubescence of the stems white-lanate; one or both faces of the calyx-tube with a basal spine. . . . . 5. *F. campestris.*"

In the fuller diagnoses the pubescence of the stem of *F. floridana* changes from "brownish" to "whitish or yellowish". Until stronger and more stable characters are found, I can hardly maintain *F. campestris* as a species.—M. L. FERNALD.

TWO FORMS OF RHODODENDRON MAXIMUM.—

RHODODENDRON MAXIMUM L., forma **album** (Pursh), stat. nov. *R. maximum*, β. *album* Pursh, Fl. Am. Sept. 297 (1814).

R. MAXIMUM, forma **purpureum** (Pursh), stat. nov. *R. maximum*, γ. **purpureum** Pursh, l. c. (1814).

—M. L. FERNALD.

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Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 43. **August, 1941.** **No. 512.**

NOTES ON THE FLORA OF NOVA SCOTIA—II

ALBERT E. ROLAND

CONSIDERABLE field work has been done by the author during the last few years, and especially during the summer of 1940 when work was confined almost entirely to the region adjacent to the province of New Brunswick. This is a region characterized by hardwood forests, rich intervales, and an inland flora; and since no botanist has studied this part of the province in any detail since it was visited by Macoun in the early years of this century and before, it seems desirable to indicate any new extensions of range and to confirm some of the old records, especially since the ranges of many of these plants indicated in the more recent manuals do not even approach this territory.

The previous records of the occurrence of the plants in the province are indicated in the following list. If no comment is made, no previous record of the plant being collected in the area is known to the author. Specimens of the plants are in the herbarium of the Nova Scotia Agricultural College, Truro, N. S.

ATHYRIUM THELYPTEROIDES (Michx.) Desv. forma ACROSTICHOIDES (Swartz) Gilbert. Typical *A. thelypteroides* is abundant in rich woods from Kings and Cumberland Counties to Cape Breton, often being the only fern on some of the rich slopes of the Cobequids. Forma *acrostichoides*, or any form approaching it, has been found but once. KINGS COUNTY: rich ravine, Cape Blomidon.

DRYOPTERIS FRAGRANS (L.) Schott, var. REMOTIUSCULA Komarov. CUMBERLAND COUNTY: near the falls, about a mile

above the paved road, Moose River; growing abundantly with *Asplenium Trichomanes* and *Woodsia ilvensis.*

This fern is common in northern Cape Breton, but this is the only known station on the mainland, as Rousseau (1) states that apparently it no longer grows at its original station for the province on the Strait of Canso.

Dryopteris Boottii (Tuckerm.) Underw. First found near Halifax and reported by Fernald (2) as common from Yarmouth to Lunenburg County. Colchester County: alluvial thicket, edge of the marsh, Glenholme. Guysborough County: swampy woods, Caledonia Mills.

Lycopodium sabinaefolium Willd., var sitchense (Rupr.) Fern. Reported by Nichols (3) as characteristic of the "grass sedge heath" in northern Cape Breton. It is also common in open pastures throughout the centre of the province. Pictou County: gravelly bank, Salt Springs, *Prince & Atwood*, No. 650; open woods above Trenton. Colchester County: mossy wet pasture above North River. Cumberland County: common in a foxberry pasture above Parrsboro.

Pinus Banksiana Lamb. Now, due to repeated fires and cutting, the dominant pine of Cumberland County. Cumberland County: abundant at Oxford on the sand plains; and common on the poorly drained country north and west of Springhill. Richmond County: common around Louisdale, the first record for Cape Breton.

Outside of a few scattered trees, which may be introduced, this tree has never been found on the pine barrens of Kings and Annapolis Counties.

Typha angustifolia L. Cumberland County: in several small scattered areas around a small lake near the head of tide, south of Amherst, growing with but much less abundant than *T. latifolia.*

Macoun lists it from Windsor; and in Lindsay's list (4) it is credited to Beaver Bank, near Halifax. Recent manuals, however, place the northern limit about Massachusetts or southern Maine.

Zizania aquatica L., var. angustifolia Hitchc. Kings County: one well developed clump in the Canard River, Lower Canard, now destroyed by road construction.

An extension of range southward from New Brunswick.

Milium effusum L. Kings County: common on the top of Cape Blomidon.

Another plant previously reported only from the richest localities between Hants County and Cape Breton.

Oryzopsis canadensis (Poir.) Torr. Previously found by Fernald at Springhill Junction; now found to be common on dry or sterile soil in the northern part of the province. Cumberland County: common with *O. asperifolia* Michx. on the sandy plains at Oxford. Colchester County: *Rhodora-Vaccinium* barren, Masstown.

Muhlenbergia uniflora (Muhl.) Fern. Previously found from Yarmouth to Halifax County, but to be expected in any part of the province. Colchester County: common in a bog near Truro. Cumberland County: common in a grassy meadow near Atkinson Siding. Victoria County: bog near Ingonish in northern Cape Breton.

Glyceria melicaria (Michx.) F. T. Hubbard. Very common and often the dominant grass in wet thickets and shady brooksides from Blomidon, Kings County, northward through Cumberland and Colchester Counties.

Glyceria fluitans (L.) R. Br. Colchester Co.: scattered in swales about Truro.

I have seen no records of this grass from the province, although *G. borealis*, on the other hand, is common throughout.

Spirodela polyrhiza (L.) Schleid. Common in slow-flowing streams of Kings and Cumberland Counties.

Allium tricoccum Ait. Kings County: common on the top of Cape Blomidon. Colchester County: rich hardwoods along the river at Kemptown.

Both localities are in rich deciduous woods in calcareous soil.

Populus tremuloides Michx., var. intermedia Victorin. Seen only once during the summer. Colchester County: damp, low woods at Bible Hill.

Polygonum arifolium L. var. lentiforme Fern. & Griscom. Common in rich thickets through the center of the province. The range is given from P. E. I. southward. Kings County: alder thicket by the Cornwallis River west of Kentville. Cumberland County: thicket by Patterson Lake, above Parrsboro; thicket near River Hebert; wet alder swamp, Economy, *Prince* No. 743.

Nuphar microphyllum (Pers.) Fern. Reported by Nichols as characteristic of ox-bow ponds in northern Cape Breton. It is also found in the few scattered lakes and ponds in Cumberland County: sinkhole in gypsum, Oxford; ox-bow ponds in the meadows above River Hebert.

Actaea rubra (Ait.) Willd., forma neglecta (Gillman)

Robinson. Common in Colchester County: edge of an intervale along Pleasant Valley.

Caulophyllum thalictroides (L.) Michx. Colchester County: one clump in rich deciduous woods along the river intervale, Kemptown.

In this narrow strip of sugar maples between the plowed fields and the river just below the paved road can be found most of the plants which are typical of the richest woodlands in the province, but which are very rarely or never seen to the south and west.

Draba arabisans Michx. Kings County: open coniferous woods on the slope of Cape Blomidon.

Previously known in the Maritimes only from Northern New Brunswick.

Tiarella cordifolia L. Listed by Lindsay from Pictou and Truro. This characteristic intervale plant of Colchester and Pictou Counties is found, together with *Trillium cernuum* and *Uvularia sessilifolia*, on most of the rich wooded hillsides or along the edges of the meadows.

Prunus serotina Ehrh. Groh (5) reports it only from Hants to Yarmouth County. This summer's field work has shown it to be not rare throughout the center of the province where large trees are often seen growing on the deep silty soils. Hants County: edge of a rich intervale, Shubenacadie. Colchester County: river bank at Gay's River. Cumberland County: many large trees along the sandy intervale roadside, Wentworth; roadside thicket, Atkinson Siding; brookside thicket, Springhill Junction.

Desmodium acuminatum (Michx.) DC. Kings County: a large area in deciduous woods along the Gaspereau River about two miles above White Rock.

The first record for the Maritimes.

Desmodium canadense (L.) DC. Long known from the intervales of Colchester and Pictou Counties. C. B. Robinson in 1902 (6) states that along "each of the three Pictou rivers may be seen the leaves of *Meibomia Canadensis* (L.) Kuntze, the flowers not appearing before the middle of July." Colchester County: Salmon River bank, east of the College Farm, Truro. *H. W. Smith*, Aug. 16, 1905.

Vicia tetrasperma (L.) Moench. Becoming a troublesome weed in the light soils of Kings and Annapolis Counties, and common around the edge of the marshes in Colchester and Cumberland.

Vicia hirsuta (L.) S. F. Gray. The range given in Britton & Brown is N. S. southw. but it is very rare in the province. Seen

but once during the summer: edge of the marshland at Glenholme, Colchester County.

Radiola linoides Roth. This tiny flax was long known in North America only from a single collection made at Louisburg, Cape Breton Island, by John Macoun. Recently A. E. Porsild (7) reported it from four additional places, all in Halifax County. It is by now, however, scattered along the whole Atlantic Coast of the Province.

At West Lawrencetown, Halifax County, it grows as thickly as grass and several cm. high over any exposed soil along the roadsides and in moist pastures close to the ocean. Richmond County: wet ground near Arichat, *Roland*, 40,524. Shelburne County: roadside, Round Bay, *Prince & Atwood*, No. 1300.

Polygala sanguinea L. Cumberland County: common in a silty acid ill-drained field, Truemanville.

Several species of Polygala in the manuals have been given ranges extending northeastward to Nova Scotia; but they are rather rare and during several seasons of botanizing this has been the only collection made.

Corema Conradii Torr. Colchester County: common in a Jack Pine barren on the site of the military training camp at Debert. Cumberland County: very common on the sandy pine barrens around Oxford.

Known to be common from Halifax westward, and reported by Rousseau from Guysborough County, it is to be expected anywhere on the peninsula where the soil is thin or sandy.

Rhamnus alnifolia L'Her. Halifax County: open pasture, Carroll's Corner. Colchester County: along meadow thickets west of Brookfield; plentiful over more than an acre of alluvial soil, East Earltown. Reported by Nichols as characteristic of poorly drained swamps in northern Cape Breton; and by Fernald from swampy woods, Springhill Junction.

This shrub is scattered on alluvial or calcareous soil through the central part of the province, and in every locality it was heavily attacked by *Puccinia coronata*.

Rhamnus Frangula L. An occasional escape around Truro and Wolfville; and abundant along roadsides near Amherst, Cumberland County.

Abutilon Theophrasti Medic. Kings County: an occasional weed, garden near Kentville.

Malva neglecta Wallr.

The small-flowered *Malva* which is common through the Annapolis Valley proves to be this species.

Viola Selkirkii Pursh. Cited in Macoun's Catalogue only from near Windsor, Hants County, and found by Rousseau in woods near Mulgrave, Guysborough County. *V. Selkirkii* is characteristic of the richer woods from Kings County to Cape Breton, although it is not common. Kings County: cool wooded ravine on the slope of Cape Blomidon. Colchester County: rich maple woods, East Earltown; common, Mapleton, *Roland* No. 40,564. Cumberland County: hardwood slope south of Amherst.

Viola eriocarpa Schwein. var. leiocarpa Fern. & Wieg.

Yellow violets are common in rich and especially alluvial soil, or calcareous areas from Kings County to Cape Breton. In Kings County they are mostly confined to the basaltic soils of the North Mountain. Along the intervales of Colchester and Pictou they are exceedingly common and are one of the first violets to bloom in the spring. The ovaries and capsules of the Nova Scotian plants have always been found entirely glabrous.

Lythrum Salicaria L.

This loosestrife seems to be introduced in numerous widely scattered places throughout the whole province. Macoun lists it as abundant in the ruins of Louisburg. Acres of the marshes below Truro are a vivid color when it is in bloom. Fernald reported it from Yarmouth; and it occurs sparingly in a swale behind a small lake at Truemanville, Cumberland County.

Osmorhiza longistylis (Torr.) DC. Reported by Robinson as a much commoner intervale plant in eastern Nova Scotia than usually supposed. It is also found in rich woodland or alluvial soils in Kings County: hardwoods on the top of Cape Blomidon, *Roland* No. 38,133; rocky roadside at Canaan, above Kentville; deep hardwoods south of Coldbrook.

The only collection seen from the northern counties seems to be the following:

O. longistylis var. brachycoma Blake. Stem with dense short spreading hairs. Cumberland County: rich alluvial roadside, Southampton, *Roland* No. 40,587.

Heracleum Sphondylium L. Very common weed in waste places and on roadsides, Truro.

Primula mistassinica Michx. Colchester County: covering a mossy bank along the Salmon River, Valley, *Roland* No.

40,618. VICTORIA COUNTY: mossy area on gypsum cliff, Cape North.

This tiny primrose, which has been reported from several places from northern Cape Breton to Colchester County is certainly one of the rarest of our plants.

LYSIMACHIA THYRSIFLORA L. This plant, mentioned in Lindsay's list as occurring at Truro and Pictou, is very common in the Salmon River Valley, Colchester County; and the marshes at Truro are yellow when it is in bloom. It is also found about every lakeside and swale in northern Cumberland County.

THYMUS SERPYLLUM L. This is the predominating plant in several fields at Truemanville, Cumberland County, where Macoun found it forty years ago; and from here it has scattered throughout the whole region around Amherst.

GALIUM BOREALE L. var. INTERMEDIUM DC. KINGS COUNTY: common along the edge of the woods on the top of Cape Blomidon, *Roland & Eaton* No. 38216.

GALIUM MOLLUGO L. Another plant reported by Macoun from Truemanville, which has become a troublesome weed to the farmers in Cumberland County.

TRIOSTEUM PERFOLIATUM L. var. AURANTIACUM (Bicknell) Wiegand.

A typical example of the distribution of many of the intervale-plants in the province. Several plants were found in a rich intervale near Truro during the summer; it was reported by Robinson from near New Glasgow; and it reappears again in northern Cape Breton where it is practically restricted to the intervales, or to rich calcareous soils.

SUCCISA PRATENSIS Moench.

This introduced plant, mentioned by Macoun as established to some extent in fields about Louisburg, is now abundant along the roadsides and in damp fields outside that town. In early September the railroad banks were a solid blue color in many places.

LOBELIA SPICATA Lam. KINGS COUNTY: common in the run-out fields and pastures on the top of Cape Blomidon.

The only other known station for the Maritimes is in eastern New Brunswick.

RUDBECKIA LACINIATA L. var. GASPEREAUENSIS Fern. (8). This indigenous variety with the undersides of the leaves and the petioles and rhachis long-pubescent, is common in the eastern

part of Kings County, and is found also in Colchester. Kings County: shady roadside gully, common, South Berwick; roadside swamp, Cambridge; roadside swale, Lower Canard. Colchester County: roadside swamp, East Mountain, Prince No. 658.

Galinsoga ciliata (Raf.) Blake. Common weed, Lower Barrington Street, Halifax.

Lapsana communis L. A garden weed, Halifax.

Hypochaeris radicata L. Yarmouth County: a serious weed in fields and lawns about Yarmouth and Arcadia.

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8. See Rhodora **24**: 205. 1922.

Nova Scotia Agricultural College,
Truro, Nova Scotia

NOTES ON JUNIPERUS[1]

C. V. Morton

Recently Mr. V. L. Cory[2] has published a paper in which he describes, as a species, *Juniperus gymnocarpa* (Lemmon) Cory, based on *J. occidentalis* var. *gymnocarpa* Lemmon. He writes, "The characteristic feature of the mature fruit, which marks it as a distinct species, is that the solitary seed, which is large for the cone containing it, is exposed at the tip for as much as one-fourth or more of the length of the seed." He also states that ". . . in fully mature fruit it is obviously distinct from all other described junipers." The form discussed has been known

[1] Published by permission of the Secretary of the Smithsonian Institution.
[2] "Three Junipers of Western Texas." Rhodora **38**: 182–187. 1936.

since the time of Engelmann, and has been considered a form of *J. monosperma*.[1]

However, the phenomenon mentioned is not unknown otherwise, being in fact one of the best known abnormalities in *Juniperus*. It was first reported about 100 years ago by Schnitzlein in his Iconographia (1843), and in the following year a similar form of *J. oblonga* M. v. Bieb. was described by Trautvetter[2] as a distinct genus *Thuiaecarpus*, with the single species *T. juniperinus*. It was soon recognized, however, that the exserted seed was not a generic character, or even a specific or varietal one, but a teratological condition. Accordingly, Trautvetter's plant was called *J. oblonga* var. *monstrosa* Antoine.[3] Later on, Ascherson and Graebner called it *J. communis* lusus *thyiocarpos*.[4]

The same abnormality was reported in *J. flaccida* Schlecht., *J. mexicana* Cham. & Schl., *J. tetragona* Schlecht., *J. isophyllos* C. Koch, and *Sabina Grisebachii* Antoine by Antoine. Schlechtendal[5] reported it in *J. communis* and *J. Sabina*. Parlatore[6] reported it in *J. procera* Hochst. and *J. phoenicea* L. Schröter[7] named a similar form *J. communis* var. *nana* lusus *gymnosperma*.

In 1917 a study of this condition was published by Professor Beck v. Mannagetta,[8] and he listed 16 species in which it had been observed. W. Kötter[9] discussed it in his "Normale and anormale Fruchtbildung bei *Juniperus communis* L." The most recent treatment is by R. Florin,[10] who found it in the Cuban species *J. saxicola* Britt. & Wils. Florin showed that this abnormal condition is caused by parasitic insects, probably of the genus *Eriophyces*. The observations of the author confirm this. All the exserted seeds examined lack an embryo and are filled with a mass of insect detritus. One of the species of insect causing these galls on United States species of juniper is *Erio-*

[1] *J. monosperma* forma *gymnocarpa* Rehd. Journ. Arn. Arb. **7**: 239. 1926.
[2] Plant. Imag. Fl. Ross. Fasc. I–II. 11. *pl. 6.* 1844.
[3] Cupress. Gatt. 24. *pl. 35.* 1857.
[4] Syn. Fl. Mitteleur. **1**: 245. 1897.
[5] Bot. Zeit. **20**: 405. 1862.
[6] In DC. Prodr. **16**, pt. 1. 1868.
[7] Ber. Schweiz. Bot. Ges. **13**: 116. 1907.
[8] Sitzungsber. K. Akad. Wiss. Wien. Math. Naturw. Kl. **126**[1]: 403–419. 1917.
[9] Dissertation, Hamburg, 1931.
[10] Arkiv för Bot. **25A**[5]: 11–13. 1933.

phyces ramosus Hodgk. (Bull. New York State Mus. **200:** 20. 1917.)

There is therefore abundant evidence that *J. gymnocarpa* Cory is not a valid species, but a monstrous form of *J. monosperma*. It has unfortunately been taken up recently by Prof. R. J. Preston[1] and assigned a range from Texas to Colorado, Utah, Nevada, and Arizona.

The nomenclature of the Mexican species of *Juniperus* is rather involved. *Cupressus sabinoides* H.B.K.[2] was briefly described from sterile material, with the suggestion that it might prove to be a species of *Juniperus*. This view was adopted by Sprengel;[3] but in transferring the species to *Juniperus* he changed the name to *Juniperus mexicana* Spreng., a procedure quite justified by the practice of the time, because the name *Juniperus sabinoides* would be considered objectionable, *Sabina* being a synonym of *Juniperus*. However, by the present rules, the name was superfluous when published, and is therefore illegitimate. Later, the name *Juniperus sabinoides* Griseb. was given to an Old World species, so the specific epithet *sabinoides* is not available for the Mexican species. The proper name is, therefore, *J. tetragona* Schlecht.[4] which was used by all authorities until recent times. The usually one-seeded form of central Texas and northern Mexico is a recognizable variety, *J. tetragona* var. *oligosperma* Engelm.

A second species was described independently in 1830 as *J. mexicana* Cham. & Schl., a quite different plant from *J. mexicana* Spreng. and belonging to a different group of species. This was renamed *J. Deppeana* Steud., which is erroneously cited by Standley[5] as a synonym of *J. mexicana* Spreng. The true *J. Deppeana* is the species called *J. pachyphlaea* by Standley, at least in part. Whether *J. pachyphlaea* Torr. can be distinguished from *J. Deppeana* is very doubtful. It does not seem that it can be, but the question must be left in abeyance. The synonymy of these species may be summarized as follows:

Juniperus tetragona Schlecht. Linnaea **12:** 495. 1838.—

[1] Rocky Mountain Trees. 1940.
[2] Nov. Gen. & Sp. 2: 3. 1817.
[3] Syst. Veg. 3: 909. 1826.
[4] Linnaea 12: 495. 1838.
[5] Contr. U. S. Nat. Herb. 23: 62. 1920.

Cupressus sabinoides H.B.K. Nov. Gen. & Sp. **2:** 3. 1817, non *J. sabinoides* Griseb. 1844. *J. mexicana* Spreng. Syst. Veg. **3:** 909. 1826 (illegitimate).—Range: Hidalgo, Durango, Mexico, Puebla, Chiapas, Guatemala.

Juniperus tetragona var. oligosperma Engelm. Trans. St. Louis Acad. **3:** 590. 1877.—*J. occidentalis* var. *conjungens* Engelm. l. c.—Range: Central Texas, Chihuahua, Coahuila, Tamaulipas, San Luis Potosí.

Juniperus Deppeana Steud. Nom. ed. 2. **1:** 835. 1840.—*J. mexicana* Cham. & Schl. Linnaea **5:** 77. 1830, non Spreng. 1826. ? *J. pachyphlaea* Torr. U. S. Rep. Expl. Miss. Pacif. **4:** 142. 1857.—Range: Doubtful. The type was from Puebla, where the species is common. The extent of the range to the north depends on whether or not *J. pachyphlaea* may be distinguished as a species.

Juniperus monosperma (Engelm.) Sarg. is called *J. mexicana* var. *monosperma* by Cory, but I believe that it may be distinguished as a species. It is found in the southwestern United States; also in northern Mexico, in Chihuahua, Coahuila, and Zacatecas.

It seems probable that there are only 10 species of *Juniperus* in the United States, namely: *J. californica*, *J. communis*, *J. flaccida*, *J. horizontalis*, *J. tetragona*, *J. monosperma*, *J. occidentalis*, *J. pachyphlaea*, *J. utahensis*, and *J. virginiana*. The following are dubious: *J. megalocarpa* Sudw. (probably a variety of *J. utahensis*), *J. Pinchotii* Sudw., *Sabina silicicola* Small, and *S. multiova* Goodw. I have seen no material of *J. erythrocarpa* Cory, from western Texas.

Up until nearly the end of the nineteenth century *J. virginiana* L. was assigned a transcontinental range. Engelmann mentioned especially its interesting distribution. But in 1897 Sargent[1] segregated the western plants as *J. scopulorum* Sarg. He has been almost universally followed since, plants from west of about the 100th meridian being called *scopulorum* and those east *virginiana*. The only tangible difference given is that the western plants are supposed to mature their fruits in two years, the eastern in one year. Even if true, this difference is not necessarily specific. Moreover, examination of many specimens from the West seems to show that the western plants may also mature fruit in a single season. All needs of taxonomy are met

[1] Gard. & For. **10:** 420. 1897.

by calling the western plant *J. virginiana* var. *scopulorum* (Sarg.) Lemmon, and the interests of phytogeography are furthered thereby. The case is similar to that of *Prunus virginiana*, the western varieties of which have been segregated as distinct species, thereby obscuring to the general botanist their relationship.

U. S. National Museum, Washington, D. C.

A MONOGRAPHIC STUDY OF ARABIS IN WESTERN NORTH AMERICA

Reed C. Rollins

(*Continued from page 325*)

3. A. blepharophylla Hooker & Arnott. Perennial; stems simple, one or few from a simple or closely branching base, pubescent with coarse, branching, appressed trichomes, rather more densely so above, rarely somewhat glabrous, 0.5–2 dm. high; basal leaves rosulate, numerous, obovate to oblanceolate, petiolate, obtuse, entire or dentate, pubescent on surfaces and margins with coarse forked or dendritic trichomes or the surfaces glabrous, 2–8 cm. long, 0.5–2 cm. broad; cauline few, ovate to oblong, entire or dentate, sessile but not auriculate, pubescent or glabrous on the surfaces, 1–2 cm. long, 4–10 mm. broad; pedicels erect, stout, pubescent, 5–10 mm. long; sepals pubescent, oblong, purplish, 6–8 mm. long, 2–3 mm. broad, outer pair saccate, inner pair non-saccate; petals rose-purple, broadly spatulate, usually retuse but sometimes merely truncate or rounded, 12–18 mm. long, 4–7 mm. broad; anthers apiculate; glands well-developed around single stamens, obsolete under paired stamens; siliques erect, glabrous, nerved to middle or above, 2–4 cm. long, 2–2.5 mm. wide; style stout when young, more slender on mature siliques, 1–2 mm. long; seeds orbicular, 1.5–2 mm. broad, narrowly winged, dark brown, uniseriate.—Bot. Beech. Voy. 321 (1840); Hooker in Bot. Mag. **33:** tab. 6087 (1874); Greene, Fl. Francis. 254 (1891); Watson in Gray, Syn. Fl. N. Am. **1:** 161 (1895); Jepson, Man. Fl. Pl. Calif. 428 (1925) and Fl. Calif. **2:** 62, fig. 136 (1936). *Erysimum blepharophyllum* (H. & A.) O. Ktze., Rev. Gen. Pl. pt. 2; 933 (1891).—Western California. Map 2. California: without locality, *Douglas s.n.* (G, isotype); Bodega Bay, Sonoma Co., March, 1902, *Heller & Brown 5178* (G, M, NY, P, US); Point Reyes, Marin Co., Feb., 1928, *Mason 4157* (R); April, 1932, *Ferris 8041* (P, UC); Sausalito, Marin Co., March, 1889, *V. K. Chesnut s.n.* (US); June, 1917, *Walker*

3393 (UC); near San Francisco, April, 1903, *Baker 1881* (G, M, NY, P, UC); April, 1903, *Heller 6591* (G, M, NY, P, UC, US); San Mateo County, April, 1903, *Elmer 4736* (M); Monterey, *Andrews s.n.* (G).

There is some variation in the distribution of the indument on the leaves of this species. The blade-surfaces may be relatively glabrous with the margins supporting a fringe of trichomes, as in the isotype specimen cited above, or the entire leaf may be pubescent. *A. blepharophylla* is a species of lower stature, shorter and more obtuse siliques and thicker styles than its relatives from southern Oregon and the extreme northern portion of California. Its flowers are relatively large and colorful. These traits have been responsible for its having been cultivated as an ornamental, both in Europe and America.

Jepson[1] has raised the question as to whether *A. blepharophylla* occurs on the Monterey Peninsula. A fragmentary specimen in the Gray Herbarium marked "Monterey, *Andrews*" in the handwriting of Asa Gray is the only evidence I have seen of its occurrence there, except published reports which were doubtless based on the same evidence. The identity of the specimen is unquestionable, but the actual location of its collection may be only an approximation as was the data preserved on many of the earlier collections sent to Gray from the West for determination. The locality, Monterey, for *A. blepharophylla* represents a considerable southward extension from recent stations, but it is deemed wise to include it as part of the range of the species, since only negative "evidence" against its occurrence on the peninsula is available. So far as I am aware, no systematic search of the entire area has been made.

4. A. **oregana** nom. nov. Perennial; stems one or few from a simple or closely branched caudex, simple or branched above, coarsely pubescent with a mixture of forked and dendritic trichomes, 3–5 dm. high; basal leaves repand to nearly entire, obovate to oblanceolate, obtuse, abruptly narrowed to a distinct petiole, 4–8 cm. long, 1–2 cm. broad, coarsely pubescent with large forked and smaller dendritic trichomes; cauline leaves oblong to ovate, entire or dentate, pubescent to nearly glabrous, sessile but not auriculate, 2–5 cm. long, 5–20 mm. broad; pedicels ascending to divaricate, pubescent, 1–2 cm. long; sepals oblong, purple, pubescent, 5–7 mm. long, 1.5–2 mm. broad, outer pair

[1] Fl. Calif. 2: 62 (1936).

saccate, inner pair non-saccate; petals spatulate, purple, rounded at apex, tapering to a narrow claw, 4–6 mm. broad, 10–15 mm. long; glands well developed and nearly surrounding single stamens, obsolete under paired stamens; siliques erect to somewhat divaricate, straight, glabrous, nerved nearly to the tip, 4–5 cm. long, about 2 mm. wide; style less than 2 mm. long; seeds dark brown, oblong, narrowly winged on sides, distal portion of wing elongated.—*A. purpurascens* Howell ex Greene in Pitt. **1**: 161 (1888), not *A. purpurascens* Presl, Fl. Sicula **1**: 50 (1826). *A. purpurascens* Howell, Fl. Northw. Am. **1**: 43 (1897) in part. *A. furcata* Wats., var. *purpurascens* (Howell) Watson in Gray, Syn. Fl. N. Am. **1**: 161 (1895), as to name only; Rollins in Res. Stud. State Coll. Wash. **4**: 18 (1936) in part.—Rogue River drainage of southwestern Oregon; Map 2. Oregon: rocky hillsides, Ashland, April 26, 1887, *Th. Howell s.n.* (ND, type; F, M, NY, UC, US, isotypes), May, 1887, *Henderson 1384* (G); junction of Siskiyou and Cascade Mts., Jackson Co., May, 1898, *Applegate 2272* (US); Roxy Ann, Jackson Co., March, 1925, *Brown 11* (FS); Jackson Canyon, Jackson Co., April, 1925, *Brown 26* (FS); Moore Ranch, Little Butte Creek, May, 1927, *Ingram 2348* (FS).

A study of the type of *A. purpurascens* Howell ex Greene at the University of Notre Dame and a mature fruiting specimen of the same collection at the Field Museum has made it clear that the species is unrelated to *A. furcata*, as was formerly supposed. Watson[1] in reducing "*A. purpurascens*" to a variety of the latter species, cited only a Howell specimen from Eight Dollar Mountain which belongs to *A. aculeolata*, indicating that he misunderstood "*A. purpurascens*" as originally described. His concept of *A. furcata*, var. *purpurascens*, which I followed in 1936,[2] was based upon specimens in the Gray Herbarium which are now referred to both *A. oregana* and *A. aculeolata*. With more and better material for study available, I am now convinced that there are three natural and discrete species belonging to the *blepharophylla*-group in southern Oregon and adjacent California.

5. A. **modesta,** sp. nov. Herba perennis; caulibus ramosis vel rare simplicibus stellato-pubescentibus 2.5–4.5 dm. altis; foliis radicalibus petiolatis obovatis obtusis repandis vel integris stellato-pubescentibus 2–6 cm. longis, 8–16 mm. latis; foliis caulinis sessilibus oblongis vel obovatis non auriculatis pubes-

[1] Gray's Syn. Fl. No. Am. **1**: 161 (1895).
[2] Res. Stud. State Coll. Wash. **4**: 18 (1936).

centibus; pedicellis divaricatis vel erectis pubescentibus 6–12 mm. longis; sepalis oblongis pubescentibus 5–7 mm. longis, 1.5–2 mm. latis; petalis spathulatis purpureis 12–15 mm. longis, 3.5–5.5 mm. latis; siliquis immaturis adscendentibus; stylo 1–2 mm. longo; seminibus ignotis.

Perennial; stems one to few from a simple or closely branched base, simple or usually branched above, 2.5–4.5 dm. high, pubescent throughout with small appressed stellate trichomes; basal leaves petiolate, obovate, obtuse, repand to entire, densely and evenly stellate-pubescent, often purplish beneath, 2–6 cm. long, 8–16 mm. broad; cauline leaves few (2–6), remote, oblong to obovate, obtuse, green, sessile but not auricled or clasping, densely pubescent, shallowly dentate to entire, 1–2.5 cm. long, 6–12 mm. wide; older flowering pedicels divaricate to more ascending, pubescent, 6–12 mm. long, elongating in fruit; sepals oblong, pubescent, 5–7 mm. long, 1.5–2 mm. wide, outer pair saccate, inner pair non-saccate; petals spatulate, tapering to a slender claw, purple to pinkish-purple, 12–15 mm. long, 3.5–5.5 mm. wide; nectar-glands U-shaped, subtending single stamens, obsolete beneath paired stamens; immature siliques glabrous, ascending; style 1–2 mm. long; mature siliques and seeds unknown.—*A. furcata* Wats., var. *purpurascens* sensu Rollins, Res. Stud. State Coll. Wash. **4:** 18 (1936) in part.—Southwestern Oregon and adjacent CALIFORNIA: Klamath River, near Horsecreek, Siskiyou Co., March, 1926, *Douthitt 5* (FS). OREGON: Josephine Co.: moist sub-shaded banks of the Rogue River, near Galice, April 18, 1926, *L. F. Henderson 5914* (RM, TYPE; M, isotype); Hellgate, Rogue River, Galice Road, May, 1927, *Gabrielson & Ingram 2247* (FS).

A. modesta is a relative of *A. oregana*, but differs markedly in its pubescence-type. The species has uniform four-parted, small, short-stalked trichomes covering the leaves and stems, whereas the indument of *A. oregana* is made up of large forked or dendritic trichomes of different sizes. In the latter species the basal leaves are somewhat ciliate, because of the large trichomes along their margins, and the lower stems are decidedly hirsute. In *A. modesta* the basal leaves are never ciliate, nor is the stem hirsute. Rather, the stem is covered with appressed stellate hairs. Unfortunately, mature fruiting material of this species has not been available. Immature specimens indicate that the siliques of *A. modesta* possess a style 1–2 mm. long. Ordinarily it would be deemed unwise to describe a new species in *Arabis* without seeing mature fruiting specimens, but in this case the

type of pubescence and its distribution upon the plants is so distinctive that I am confident the species is undescribed.

6. A. McDonaldiana Eastwood. Perennial; stems few to many from a branching caudex, simple, glabrous, 5–20 cm. high, slender; basal leaves rosulate, spatulate, repand to somewhat toothed, glabrous or the few teeth rarely bristle-tipped, 1–2 cm. long, 4–7 mm. broad; cauline leaves small, oblong, remote, entire, sessile, 4–7 mm. long, 2–3 mm. broad; pedicels ascending, glabrous, 8–10 mm. long; sepals oblong, glabrous, 5–6 mm. long, 1.5–2 mm. broad, outer pair saccate, inner pair non-saccate; petals rose-purple, narrowly spatulate, truncate or somewhat rounded at apex, gradually tapering to a narrow claw, 9–11 mm. long, 2.5–3 mm. broad; nectar-glands U-shaped, around single stamens, obsolete beneath paired stamens; immature siliques erect or somewhat divaricate, glabrous, 3–4 cm. long; seeds unknown.—Bull. Torr. Bot. Club **30:** 488 (1903). *A. blepharophylla* H. & A., var. *macdonaldiana* (Eastw.) Jepson, Man. Fl. Pl. Calif. 429 (1925) and Fl. Calif. **2:** 62 (1936).—Map 2. California: Red Mountain, near Bell Spring, Mendocino Co., May 21–28, 1902, *Eastwood s.n.* (G, NY, UC, US, isotypes).

This entity is very closely related to *A. aculeolata* Greene, which has a restricted range in southern Oregon. However, *A. McDonaldiana* differs in being entirely glabrous, of lower stature, and in possessing slender, truncate petals. Though little is known of *A. McDonaldiana*, its inclusion as a variety of *A. blepharophylla* where it was placed by Jepson, l. c., is more open to question than would be its association with *A. aculeolata*. Until further exploration of northwestern California yields more and better material, the limits of specific variation and geographical distribution will remain in doubt. *A. McDonaldiana* has much narrower petals than any of its relatives and is the only completely glabrous member of its immediate group.

7. A. aculeolata Greene. Perennial with a branching caudex which is often invested with old leaf-bases; stems few to several, simple, few-flowered, densely hirsute with large simple or forked trichomes, often nearly glabrous above, 2–3.5 dm. high; basal leaves rosulate, obovate to oblanceolate, obtuse, entire or somewhat repand, densely hirsute or the surfaces rarely less so, 1–4 cm. long, 5–10 mm. broad; cauline sessile, not auriculate, entire to few-toothed, hirsute, remote, 5–15 mm. long, 3–6 mm. broad; pedicels erect or slightly diverging, hirsute, 1–1.5 cm. long; sepals pubescent, purple, 1.5–3 mm. wide, 6–9 mm. long, outer pair saccate, broader than the inner, inner pair non-saccate;

petals purple, spatulate, tapering rather abruptly to a narrow claw, 12–20 mm. long, 5–8 mm. broad; nectar-glands well developed at base of short stamens, obsolete beneath long stamens; siliques glabrous, erect, nerved almost to apex, prominently veined, 3.5–6.5 cm. long, about 2 mm. wide; style slender, 1–2 mm. long; seeds orbicular to somewhat oblong, narrowly winged all around, 1.5–2 mm. broad, dark brown, uniseriate.—Leaflets **2:** 69 (1910). *A. furcata* Wats., var. *purpurascens* Watson in Gray, Syn. Fl. N. Am. **1:** 161 (1895) in part; Rollins in Res. Stud. State Coll. Wash. **4:** 18 (1936) in part. *A. purpurascens* sensu Howell, Fl. Northw. Am. **1:** 43 (1897) in part.—Southwestern OREGON: JOSEPHINE CO.: Eight Dollar Mt., May, 1884, *Th. Howell 35* (G), June, 1904, *C. V. Piper 6256* (US, TYPE); near Selma, March, 1926, *Henderson 5721* (M, RM), May 1, 1924, *Savage s.n.* (UC), May, 1927, *Gabrielson & Ingram 2230* (FS); near O'Brien, April, 1934, *Thompson 10239* (M, NY, US, UW, W); Waldo, April, 1924, *Eastwood & Howell 1404* (G), June, 1884, *Th. Howell s.n.* (G, NY, O, UC, US, WSC); Rough & Ready Creek, April, 1930, *Applegate 6140* (G), May, 1933, *Tracy 12521* (UC).

A. aculeolata is another singular endemic of the "Klamath Region" of southwestern Oregon. The species is related to *A. furcata* on the one hand and to *A. oregana* on the other. From *A. furcata,* with which it agrees in general habit, *A. aculeolata* differs in having much larger purple instead of white flowers, hirsute instead of glabrous upper stems, pedicels and sepals; also the seeds are winged all around rather than merely on the distal end. Actually, *A. aculeolata* is more closely related to all the purple-flowered species of the group than to *A. furcata,* where it has often been included in var. *purpurascens.*

A. aculeolata is distinguished from *A. oregana,* its nearest relative, by its multicipitally branching caudex, smaller basal leaves, shorter stems, uniformly simple or at most forked pubescence, erect pedicels and prominent style 1–2 mm. long. In *A. oregana,* the caudex is usually simple, but may have one or two close branches; the pubescence is made up of a mixture of large forked trichomes with bulbous bases and smaller dendritically branched ones; the pedicels are divaricate, and the siliques have sessile or nearly sessile stigmas.

8. A. FURCATA Watson. Perennial; stems one or usually several from a simple or branching caudex, slender, simple, erect or ascending, glabrous to sparsely pubescent near the

base, 1–4 dm. high; basal leaves numerous, obovate to spatulate, tapering to a narrow petiole, glabrous to sparsely hirsute, ciliate with forked or simple trichomes along the margins to rarely glabrous, entire to repand or remotely dentate, 2–5 cm. long, blade 5–20 mm. wide; cauline leaves smaller, sessile, entire or rarely dentate, obovate to oblong-lanceolate, mostly glabrous, 1–2 cm. long; sepals oblong, glabrous, 2–4 mm. long, outer pair saccate, inner pair non-saccate; petals white, spatulate, 5–10 mm. long, 2–4 mm. wide, conspicuously veined; nectar-glands surrounding base of single stamen, poorly developed below paired stamens; pedicels ascending, straight, glabrous, 0.5–1.5 cm. long; siliques erect, straight or nearly so, glabrous, 2–4 cm. long, about 2 mm. wide, valves constricted between the seeds, conspicuously one-nerved from base to apex; style about 1 mm. long; seeds oblong-elliptical to nearly orbicular, winged at the distal end only, 1.5–2 mm. long, uniseriate; funiculus nearly equaling the seeds in length.

8a. Var. **typica.** *A. furcata* Watson in Proc. Am. Acad. **17:** 362 (1882) and in Gray, Syn. Fl. N. Am. **1:** 161 (1895); Howell, Fl. Northw. Am. **1:** 43 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 293 (1906); Piper & Beattie, Fl. Northw. Coast 171 (1915); Rollins in Res. Stud. State Coll. Wash. **4:** 17, fig. 5 (1936); G. N. Jones in Univ. Wash. Pub. Biol. **7:** 91 (1939). *A. Suksdorfii* Howell, Fl. Northw. Am. **1:** 43 (1897).—Washington and Oregon. Map 6. Oregon: bluffs of the Columbia, near mouth of Hood River, May 18, 1882, *J. & T. J. Howell s.n.* (G, type); Mitchell Point, May & June, 1909, *Suksdorf 1368* (G, R, UC, US, WSC); Hood River, June, 1879, *J. Howell s.n.* (G); Mt. Hood, July, 1895, *Langile 67* (US), July, 1926, *English 282* (WSC); Elk Cove, Hood River Co., Aug., 1927, *English 837* (WSC); Olallie Mt., near Mt. Jefferson, July, 1928, *Leach & Leach 1974* (O). Washington: Three Brothers Peak, June, 1934, *Thompson 10743* (T, UW), Aug. 1935, *Thompson 12641* (G); Mt. Stuart region, Chelan Co., Aug., 1930, *Thompson 5797* (G); Mt. Stuart, July, 1898, *Elmer 1223* (US, WSC); Earl Ridge, Wenatchee Mts., July, 1933, *Thompson 9549* (G, T); head of Beverly Creek, Kittitas Co., July, 1932, *Thompson 8718* (G); Owyhigh, Mt. Rainier, Aug., 1919, *Flett 3161* (WSC); King Mt., Aug., 1899, *Suksdorf s.n.* (R); upper Ahtanum River, Yakima Co., Aug., 1892, *Henderson 58* (UW, WSC); Flat Top Mt., June, 1923, *Pearson 371* (WSC); Mt. Adams (Paddo), Aug. 10, 1882, *T. Howell s.n.* (O, type; G, isotype of *A. Suksdorfii*), Oct. 1892, *Suksdorf 2472* (G); Chiquash Mts., Skamania Co., Aug., 1895, *Suksdorf 2431* (G).

8b. Var. olympica (Piper) Rollins. Stems simple, slender, hirsute with branched trichomes; inflorescence subcorymbose;

siliques erect, narrowly linear, 18–24 mm. long.—Res. Stud. State Coll. Wash. **4:** 19 (1936). *A. olympica* Piper in Contrib. U. S. Nat. Herb. **16:** 208 (1913); Piper & Beattie, Fl. Northw. Coast 170 (1915); G. N. Jones in Univ. Wash. Pub. Biol. **5:** 158 (1936).—WASHINGTON: near Humes Glacier, base of Mt., Olympus, Jefferson Co., Aug. 12, 1907, *Flett s.n.* (US, TYPE; WSC, isotype).

The alpine or high mountain phase of *A. furcata* tends to be more nearly glabrous, thicker-leaved, and slightly dwarfed as compared with plants from the type station in the gorge of the Columbia River. However, there is no good evidence that the alpine plants really represent a discrete taxonomic entity. The distinctive characteristics of *A. furcata* run through the entire series, leaving no doubt as to the continuity of form and structure. Without experimental evidence, it is impossible to know whether the superficial differences between the "Columbia Gorge" phase and the high altitude phase from the adjacent Cascade Ranges are constant, but on the basis of their morphology and geographical distribution, it seems most satisfactory to treat them as a single species. Therefore, *A. Suksdorfii* is considered to be an unequivocal synonym of *A. furcata*.

The type of var. *olympica* has been re-examined since my former treatment, op. cit., and the disposition given there seems valid. There is a slight possibility that the specimens upon which var. *olympica* was established will eventually be considered to be a depauperate form of *A. hirsuta*. More material together with accurate field observations in the type region are needed before the disposition of var. *olympica* can become more conclusive.

9. A. NUTTALLII Robinson. Perennial; stems several to numerous from a branching caudex, simple, slender, erect to slightly decumbent at base, glabrous above, hirsute with rather long simple or often forked trichomes below, 6–35 cm. high; basal leaves spatulate-oblanceolate to obovate, obtuse, rosulate, entire, petiolate, ciliate and hirsute on both surfaces to glabrous, thin and membranaceous or sometimes coriaceous, 1–4 cm. long, 4–10 mm. wide; cauline leaves oblong to somewhat elliptical, sessile, not auriculate, hirsute on both surfaces to glabrous, 5–15 mm. long; nectar-gland surrounding base of single stamens, very small or obsolete beneath paired stamens; sepals oblong, sparsely pubescent or glabrous, 2–4 mm. long, outer pair saccate, inner pair non-saccate; petals white, spatulate, 5–8 mm. long, 2–4 mm.

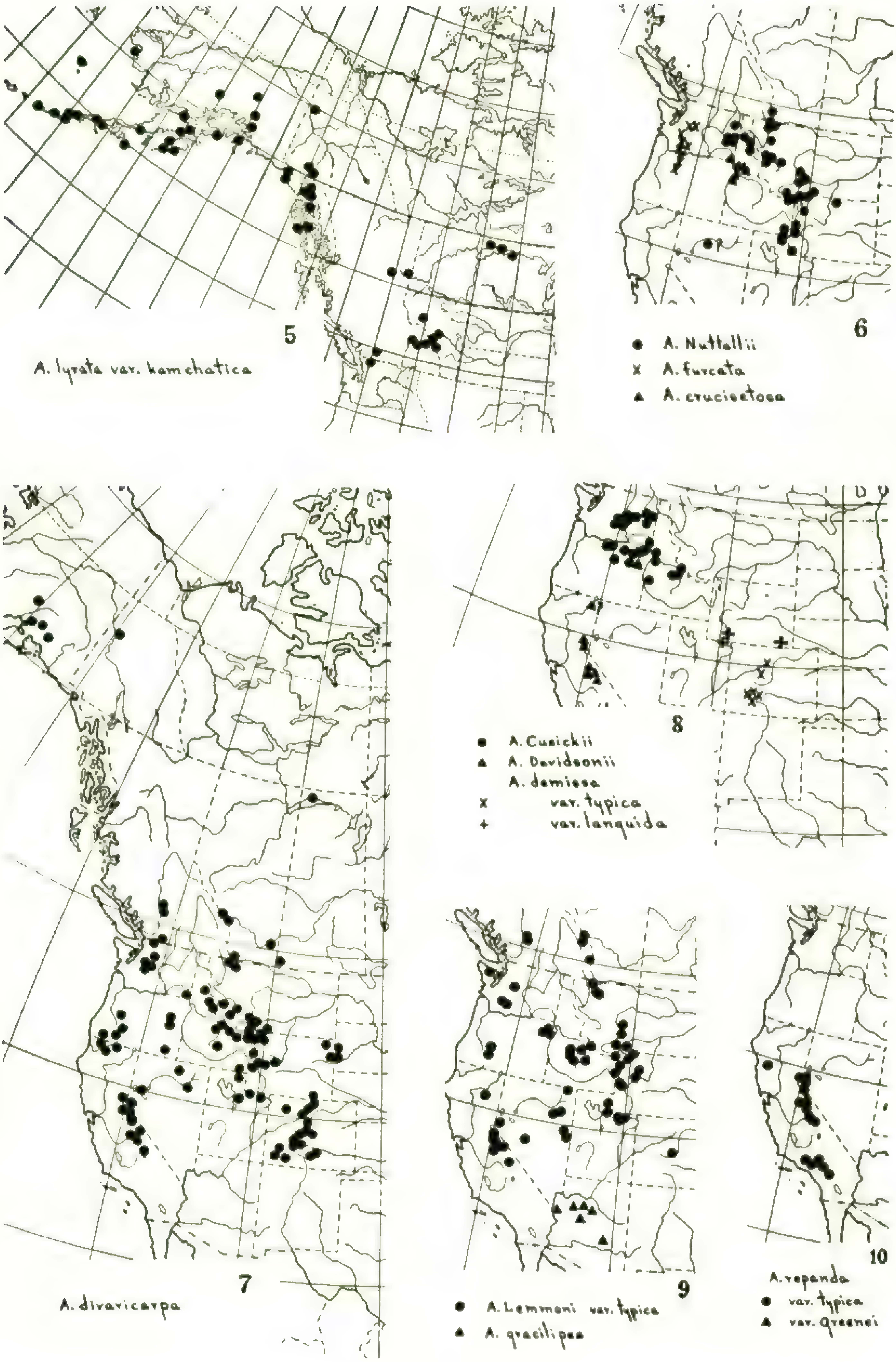
wide; pedicels glabrous, slender, divaricately ascending, 5–20 mm. long; siliques erect to slightly spreading, straight, glabrous, inconspicuously 1-nerved or the nerve obsolete, 1–3 cm. long, 0.8–1.5 mm. wide; style slender, about 1 mm. long; seeds small, less than 1 mm. broad, oblong, wingless, uniseriate; cotyledons accumbent.—In Gray, Syn. Fl. N. Am. **1:** 160 (1895); Howell, Fl. Northw. Am. **1:** 42 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 292 (1906); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 358 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 243 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 12, fig. 4 (1936). *A. spathulata* Nuttall in T. & G., Fl. N. Am. **1:** 81 (1838), not *A. spathulata* DC., Syst. **2:** 227 (1821). *Erysimum Nuttallii* O. Ktze., Rev. Gen. Pl. pt. **2:** 933 (1891). *A. bridgeri* M. E. Jones, Contrib. West. Bot. **14:** 38 (1912). *A. macella* Piper in Proc. Biol. Soc. Wash. **33:** 103 (1920).—Alberta to Wyoming, Nevada? and Washington. MAP 6. WITHOUT DEFINITE LOCALITY (probably Wyoming): Platte River, Rocky Mountains, *Nuttall s.n.* (G, isotype). ALBERTA: Crow Nest Pass, Aug., 1897, *J. Macoun 18162* (G, ND, NY). MONTANA: Logan Pass, Glacier Co., June, 1934, *Maguire et al. 1503* (R, UAC); Upper Marias Pass, Aug., 1883, *Canby 17* (G); Columbia Falls, June, 1893, *R. S. Williams 167* (RM, US); Helena, Clark Co., May, 1889, *F. D. Kelsey s.n.* (UC); Bridger Mts., June, 1897, *Rydberg & Bessey 4230* (G, NY, RM, US, WSC); Mt. Bridger, Gallatin Co., Aug. 10, 1905, *M. E. Jones s.n.* (P, TYPE of *A. bridgeri*); Red Rock Lake, Madison Co., June, 1899, *A. & E. Nelson 5479* (G, RM, US); Rock Creek Canyon, Carbon Co., July, 1937, *L. O. & R. Williams 3590* (G, R). WYOMING: near Medicine Mt., Big Horn Co., July, 1936, *L. O. & R. Williams 3346* (R); 15 miles east of Kane, June, 1936, *L. O. & R. Williams 3025* (G, M, R); Soda Butte, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson 5833* (RM); 15 miles northeast of Bondurant, Sublette Co., Aug., 1922, *E. B. & L. B. Payson 3024* (G, RM, UC, US); Sheep Mt., near Alpine, Lincoln Co., July, 1923, *Payson & Armstrong 3461* (G, RM); hills east of Afton, June, 1923, *Payson & Armstrong 3273* (G, RM); Evanston, Uinta Co., May, 1897, *A. Nelson 2961* (RM, WSC). IDAHO: high mts., Kootenai Co., Aug., 1892, *Sandberg s.n.* (UW, WSC); Wiessners Peak, Kootenai Co., July, 1892, *Sandberg et al. 601* (G, UC, US); divide between St. Joe and Clearwater Rivers, Shoshone Co., July, 1895, *Leiberg 1239* (G, RM, UC, US); Bear-skull Mt., July, 1929, *Epling s.n.* (UCLA); Camas Meadows, Clark Co., June, 1938, *Davis 337* (G, R); Henry Lake, Fremont Co., July, 1920, *E. B. & L. B. Payson 1985* (G, RM); near Soda Springs, Caribou Co. (formerly Bannock Co.), June, 1920, *E. B. & L. B. Payson 1722* (G, RM), May, 1939, *Davis 826* (R).

Utah: Cache Co.: Lewiston, May, 1911, *C. P. Smith 2367* (NY, RM); Logan Canyon, *Muenscher & Maguire 2347* (UAC), May, 1909, *C. P. Smith 1572* (RM); 3 miles west of Logan, May, 1932, *Maguire 3452* (G, M, UAC); Mt. Magog, July, 1936, *Maguire et al. 14066* (G, R, UAC). Nevada: Sonoma Range (Havallah Mts.), Humboldt-Pershing Cos., June, 1868, *S. Watson 67* (G). Washington: Columbia River Valley, May, 1911, *Gabby 65* (WSC); Spokane, May, 1899, *Piper 2950* (WSC); Medical Lake, Spokane Co., May, 1893, *Sandberg & Leiberg 50* (Cl, G, O, UC, US, WSC); Crab Creek, Lincoln Co., June, 1884, *Suksdorf 238* (G, WSC); Sprague, Lincoln Co., June, 1893, *Sandberg & Leiberg 202* (G, UC, WSC); near Rock Lake, Whitman Co., May, 1936, *Rollins & Constance 1096* (G, R, WSC); Ritzville, Adams Co., June 11, 1893, *Sandberg & Leiberg 202* (US, type; O, isotype of *A. macella*).

Since my former treatment of this species,[1] a number of new collections have been studied, particularly from Utah where both the high-altitude and lowland phases have been collected in abundance by Dr. Bassett Maguire. It was previously concluded that *A. Nuttallii* showed recognizable tendencies in a lowland phase named *A. macella* by Piper and a sub-alpine phase named *A. bridgeri* by Jones. The lowland phase of *A. Nuttallii* is recognizable because of its taller habit, weak, slender stems and long, slender pedicels. Plants of this phase have been collected in Montana, Idaho, Utah and Washington or at local stations roughly approximating the range of the species.

The high-altitude phase of *A. Nuttallii* is nearly or wholly glabrous, the leaves are thickish and the pedicels tend to be reduced. Plants of this phase are apt to be a trifle more robust with a more highly branched caudex than the usual phase of the species. These nearly glabrous plants have been collected at mountain stations in Montana, Idaho, Wyoming and Utah. It has been pointed out elsewhere that many species of *Arabis* which have a rather wide altitudinal occurrence are likely to develop a glabrous phase at high elevations. In some instances, for example in *A. platysperma,* the glabrous condition is accompanied by correlated minor morphological differences and a distinctive geographical range. In such cases, it seems worth while formally to recognize these correlated divergences from the typical pattern by applying a varietal epithet to the plants

[1] Res. Stud. State Coll. Wash. **4**: 14 (1936).



Rollins on Arabis

which fall into this category. On the other hand, if glabrous plants appear here and there throughout the range of a species, probably in response to ecological rather than genetical factors; if these plants do not have significant correlated characters or a distinctive geographical range; and particularly, if there is intergradation with the usual phase of the species, it seems hardly necessary to designate them nomenclaturally. *A. Nuttallii* is a species of the latter type in which a transitional series from a rather lax, pubescent lowland type to a compact, glabrous, high-altitude type might be encountered almost anywhere in its range where the plants are abundant and suitable habitats are to be found.

I have seen a single collection of undoubted *A. Nuttallii* which supposedly came from Nevada. The specimen is Watson's number 67 labeled, "Arabis hirsuta Scop., Havallah Mts. [now known as the Sonoma Range], N. Nevada, June, 1868". The data on this specimen may be perfectly accurate, but one's suspicion is aroused by two items. (1) Watson reported this collection under *Arabis hirsuta* in the Botany of King's Expedition[1] as being from the "Wahsatch and Uinta Mountains, Utah". (2) The station is several hundred miles from the nearest known locality for the species and is outside the expected range. Undoubtedly this collection was the basis for Robinson's inclusion of "N. Nevada" in the range of *A. Nuttallii* in the Synoptical Flora, l. c.

10. A. CRUCISETOSA Constance & Rollins. Perennial; caudex simple or branched; stems several to numerous, rarely single, simple or sometimes branched above, slender, glabrous to sparsely pubescent below, 1–4 dm. high; basal leaves numerous, spatulate to obovate, obtuse, petiolate, entire to sparsely dentate, harshly pubescent with dendritic cross-shaped or three-pronged trichomes, rarely almost glabrous, dark green above, paler to purplish below, 2–6 cm. long, 6–15 mm. wide, petiole nearly equalling the blade in length; cauline leaves few, sessile, not auriculate, entire or rarely few-toothed, linear-oblong, obtuse, 1–3 cm. long, 2–6 mm. wide, pubescent to glabrous on the surfaces, margins always pubescent; sepals oblong, yellowish, rarely purple-tipped, scarious-margined, glabrous, 3–4.5 mm. long, outer pair saccate, inner pair non-saccate; petals lingulate, white, 6–9 mm. long, 2.5–3 mm. wide; pedicels slender, glabrous, di-

[1] King, Geol. Expl. Fortieth Parallel 5: 16 (1871).

varicate, 1–2 cm. long; stamens very unequal, filaments projecting into a small apiculate tip above the anthers; nectar-glands surrounding single stamens, very poorly developed beneath paired stamens; siliques erect, glabrous, straight or nearly so, nerved below, 2–4 cm. long, 1–1.5 mm. wide; style about 1 mm. long; seeds oblong, about 1 mm. broad, wingless, uniseriate.—Proc. Biol. Soc. Wash. **49:** 147 (1936); St. John, Fl. Southeastern Wash. Adj. Idaho 164 (1937).—Western Idaho and adjacent Washington. Map 6. Idaho: Nez Perce Co.: 19 miles east of Spalding, June, 1937, *Constance, Hedrick & Peters 1886* (G, R, WSC); near the Clearwater River, 27 miles east of Lewiston, April, 1936, *Beinke 83* (G); 10 miles east of Lewiston, April, 1930, *Maxfield 46* (G, R). Idaho Co.: between Steep Creek and Willow Creek, Snake River Canyon, May 16, 1936, *Rollins, Constance & Dillon 1107* (WSC, type; G, M, NY, R, isotypes); between Lightning Creek and middle fork of Sheep Creek, May, 1936, *Baubier, Fosberg & Hardt 74* (G, R, WSC); Little Granite Creek, 1 mile above its mouth, May, 1937, *Packard, Moore & Katznelson 207* (G, R). Washington: Lime Point, Asotin Co., April, 1928, *St. John 9294* (R, WSC).

Arabis crucisetosa is nearest related to *A. Nuttallii* which it resembles in general habit and many important morphological features. The foliage, seeds, disposition of siliques, style-length and color and size of flowers are all similar in the two species. However, there is no difficulty in distinguishing between them because of the great difference in type of pubescence. In *A. crucisetosa* the trichomes are dendritic with four (rarely three) prongs raised on a central stalk, but in *A. Nuttallii* the trichomes are very much coarser and simple or at most merely forked. Besides this marked difference, *A. crucisetosa* is a taller species with longer pedicels and siliques and narrower cauline leaves which tend to become dentate. *A. crucisetosa* is rather common in the Transition and Lower Canadian Life-zones on high hills and in the mountains bordering the Snake River drainage in western Idaho and adjacent Washington. The known distribution is limited, but an extension is to be expected at least to the Oregon side of the Snake River.

11. A. lyrata L., var. kamchatica Fischer ex DC. Stems simple or branched, often flexuose, 1–4 dm. high; basal leaves pinnatifid to coarsely dentate or nearly entire, lyrate, spatulate or obovate, petiolate, pubescent with simple or forked trichomes or usually glabrous, 2–6 cm. long; cauline leaves sessile, not auriculate, oblong to broadly spatulate, entire to coarsely dentate,

1

2

3

Fig. 1. A. aculeolata drawn from *T. Howell* s. n. collected in 1884; Fig. 2. A. rigidissima drawn from *Tracy 14469* (type); Fig. 3. A. Fernaldiana drawn from *Rollins & Chambers 2520.* All figures about one-half natural size.

glabrous; petals white to pinkish, 4–8 mm. long; outer sepals saccate, inner non-saccate; siliques erect to divaricately ascending, glabrous, 1–1.5 mm. wide, 1.5–4 cm. long; style very short or absent, rarely up to 1 mm. long; seeds wingless, oblong, uniseriate, about 1 mm. broad, cotyledons accumbent.—*A. lyrata*, var. *kamchatica* Fischer ex DC., Syst. **2:** 231 (1821); Nakai in Tok. Bot. Mag. **32:** 239 (1918); Hultén, Fl. Kamtchatka **2:** 165 (1928); Hopkins in Rhodora **39:** 92 (1937). *A. ambigua*, var. *glabra* DC., l. c. *A. ambigua*, var. *intermedia* DC., l. c. *A. arenosa* sensu Cham. & Schlecht. in Linnaea **1:** 17 (1826). *A. ambigua* sensu Hooker, Fl. Bor.-Am. **1:** 42 (1829). *A. kamchatica* (Fisch.) Ledeb., Fl. Ross. **1:** 121 (1842); Busch in Notul. Syst. Hort. Bot. Petrop. **3:** 11 (1922), Fl. Sib. Orient. Ext. **4:** fam. 25. 466 (1926) and in Komarov, Fl. U.R.S.S. **8:** 192 (1939) as *kamtschatica*. *A. lyrata*, var. *occidentalis* Watson in Gray, Syn. Fl. N. Am. **1:** 159 (1895); Piper in Contrib. U. S. Nat. Herb. **11:** 292 (1906); Rollins in Res. Stud. State Coll. Wash. **4:** 9 (1936). *A. media* var. *glabra* (DC.) Busch, Fl. Sib. Orient. Est. **4:** fam. 25. 465 (1926). *A. media*, var. *intermedia* (DC.) Busch, ibid. *A. kamtschatica*, var. *glabra* (DC.) Busch, ibid. p. 468. *A. kamtschatica*, var. *intermedia* (DC.) Busch, ibid. *A. lyrata*, var. *glabra* (DC.) Hopkins, op. cit. p. 93. *A. lyrata*, subsp. *kamtschatica* (Fisch.) Hultén, Fl. Aleut. Is. 202 (1937). *A. occidentalis* (Wats.) A. Nelson in Univ. Wyoming Pub. **3:** 111 (1937). *Cardaminopsis kamtschatica* (Fisch.) O. E. Schulz in Engler, Pflanzenf. Aufl. 541 **17b:** 2 (1936).—Saskatchewan to Washington, Alaska and the Aleutian Islands; eastern Asia. Map 5. Saskatchewan: 5 miles east of Poplar Pt., Lake Athabaska, July, 1935, *Raup 6684* (G); vicinity of Wolverine Pt., Lake Athabaska, July, 1935, *Raup 6706* (G); Charlot Pt., Lake Athabaska, June, 1935, *Raup 6132* (G). Alberta: Maligne Lake, July, 1908, *Brown 1169* (G); Independence Branch, Pobocton Creek, July, 1908, *Brown 1355* (G); Mt. Temple, Laggan, Aug., 1904, *Butters & Holway a8* (G); vicinity of Lake Louise, July, 1916, *Hunnewell 4356* (G). Washington: Heliotrope Ridge, Mt. Baker, Whatcom Co., Aug., 1934, *Thompson 11239* (G, RM, T, UW); Nooksack River, near Mt. Baker, 1890, *Suksdorf 1999* (G, WSC), specimen cultivated at Bingen, Wash. British Columbia: Lower Allokagnik Lake, 1882, *McKay s.n.* (G); Bishop Range, Selkirk Mts., Aug., 1908, *Butters & Holway 447* (G); Fraser River Valley, May, 1875, *Macoun 132* (G); Carbon River about 4 miles above the Peace River, Aug., 1932, *Raup & Abbe 4267* (G); Mt. Selwyn, July, 1932, *Raup & Abbe 3797, 4096 & 4153* (G). Yukon: Lake Lindeman, head of Yukon R., June, 1883, *Schwatka 19* (G); Klondyke Bottom, Dawson, June, 1914, *Eastwood 191* (Cl, G); Carcross, July, 1914, *Eastwood 708* (Cl, G). Alaska: Sitka, *Bongard s.n.* (G); Admirality

Is., June, 1915, *Walker 716* (G); Juneau, *Hultén 8112* (L); Skagway, 1910, *Kusche s.n.* (G); Yakutat, June, 1916, *Walker 1055* (G); Seward, June, 1937, *Scamman 525* (G, L); Tutka Bay, Kenai Pen., *Hultén 7776* (L); Rapids Lodge, 138 miles south of Fairbanks, Aug., 1937, *Scamman 1001* (G, L); Mt. McKinley Nat. Park, June, 1937, *Scamman 630* (G, L); vicinity of Karluk, Kodiak Is., June, 1903, *Rutter 29* (G); Olga Bay, Kodiak Is., June, 1936, *E. H. & H. B. Looff 642* (G, R); St. Paul Is., Aug., 1891, *Macoun s.n.* (G); Tanunak, Nelson Is., 1933, *Geist s.n.* (L); Dutch Harbor, Unalaska, June, 1907, *Van Dyke 61* (G); Schumagin Is., July, 1899, *Kincaid s.n.* (L); Nikolski, Umnak Is., *Hultén 5688* (L); Atka Is., *Eyerdam 1144a* (L).

Two varieties of *A. lyrata* were recognized by Hopkins[1] as occurring in northwestern North America, var. *kamchatica* and var. *glabra*. The essential points used to separate them were flower-size and presence or absence of pubescence on the stem and basal leaves. An attempt was made to follow this interpretation, but the study of a large series of specimens has shown that there is considerable variation in flower-size among glabrous plants and that presence in quantity or scantiness of pubescence is not correlated with or confined to either large- or small-flowered forms. Admittedly there is great variation in the characters mentioned, but this variation is not restricted to any given set of characters. The plants as a whole as well as their parts vary tremendously in size. These variations seem to occur in all possible combinations so that it is impossible satisfactorily to split var. *kamchatica* without making innumerable micro-entities. In this case it is preferable to place these plants in a single variety. Hultén[2] reached the same conclusion after a serious study of the variety in Kamtchatka, even though the same forms occur there.

Var. *kamchatica* tends to have broader, usually longer, siliques, coarser stems, shorter styles and less divided basal leaves than var. *typica*. The plants are usually glabrous or very nearly so, which is seldom the case in var. *typica*. The type of var. *kamchatica* has not been seen and it is not known whether one is actually in existence. There is more than a chance that both var. *glabra* and var. *kamchatica* were based on the same collection, since DeCandolle's var. *glabra* (as shown by a photo-

[1] Rhodora **39**: 88–98 (1937).
[2] Fl. Kamtchatka and Adj. Islands **2**: 167 (1928).

graph of the type in the Gray Herbarium) was based on specimens from the herbarium of Pallas communicated to DeCandolle by Fischer in 1819. Var. *kamchatica* was credited to Fischer "in litt" (as a species) by DeCandolle. A summary of the facts shows that there is but a single variety of *A. lyrata* in northwestern North America and Kamtchatka and that var. *kamchatica* is the oldest varietal epithet available for it under this species. The differences between var. *kamchatica* and var. *typica* are not striking nor invariable, and for this reason I do not consider var. *kamchatica* to be a particularly strong variety.

12. A. Davidsonii Greene. Perennial with a deep, simple or branched caudex; stems several, slender, glabrous, simple, 5–15 cm. high; basal leaves oblanceolate-cuneate to spatulate, obtuse, entire or with a few teeth near apex, glabrous, thickish, 3–8 cm. long, 4–12 mm. wide; cauline leaves oblong to cuneiform, entire, few, glabrous, sessile, not auriculate, 6–15 mm. long, 3–6 mm. wide; sepals glabrous, oblong, 4–5 mm. long, 1–1.5 mm. wide; petals spatulate, rounded at apex, white to pinkish, 8–10 mm. long, 2–3.5 mm. wide; glands well developed below single stamens, poorly developed below paired stamens; pedicels divaricate, glabrous, 1–1.5 cm. long; siliques divaricate, glabrous, straight to somewhat falcate, nerved to the middle or above, 3–5 cm. long, 1.5–2 mm. broad; style evident but very short; seeds orbicular, narrowly winged all around, 1.5 mm. broad, uniseriate.—Leaflets **2:** 159 (1911); Jepson, Fl. Calif. **2:** 65 (1936). *A. Lyallii* Watson, var. *Davidsonii* (Greene) Smiley in Univ. Calif. Pub. Bot. **9:** 205 (1921). *A. Brucae* M. E. Jones, Contrib. West. Bot. **14:** 37 (1912). *A. cognata* Jepson, Man. Fl. Pl. Calif. 429 (1925) and Fl. Calif. **2:** 64 (1936).—California and Oregon. Map 8. California: below Sabrina Lake, Bishop Creek, Inyo Co., July 11 (no year given), *A. Davidson 2728* (ND, type; UC, isotype); South Lake, Inyo Co., July, 1913, *A. Davidson 2935* (G); Ledge Trail, Yosemite, *Chandler & Babcock 1033* (UC); Yosemite Valley, July, 1902, *Hall & Babcock 3436* (UC); Little Kern River, Tulare Co., June, 1896, *Purpus 1795* (UC); Mt. Elwell, Plumas Co., July 11, 1912, *Mrs. C. M. Wilder s.n.* (UC, type; US, isotype of *A. cognata*); Slate Creek, Plumas Co., May, 1877, *Mrs. R. M. Austin s.n.* (M, NY, US); Summit, Nevada Co., July, 1902, *M. E. Jones s.n.* (P); Donner Pass, Nevada Co., Aug., 1903, *Heller 7121* (G, M, ND, NY, US); Salmon Lake—Gold Lake, Sierra Co., July, 1921, *H. M. Evans s.n.* (F); Hills near Davis Creek, June, 1898, *Mrs. Austin & Mrs. Bruce 2251* in part (P, type of *A. Brucae*); Redwood Creek, near affluence of the south and middle forks of Kings River, Fresno Co., April,

1939, *Belshaw 5029* (R, UC). Oregon: Baker County, July, 1887, *Cusick 949* (G).

Arabis Davidsonii is distantly related to *A. Lyallii* with which it has been confused and which it resembles in a general way. However, the species is easily distinct and if the caudex-crowns are present, no difficulty should be experienced in determining specimens. The basal leaves and flowers are much larger in *A. Davidsonii* than in *A. Lyallii* and the caudex-crowns differ in being very thick as a result of the old leaf-bases which invest them. The remarkable caudex-branches of this species sometimes penetrate the soil more than a decimeter before they are joined to the principal root. These underground caudex-branches retain the persistent leaf-bases along their entire length, but at the summit of each branch a definite crown from 1 to 3 centimeters across is formed.

The Cusick specimen cited above is apparently typical of the species. It is of interest because of its complete isolation from the known stations for *A. Davidsonii* in California. Perhaps subsequent exploration in the mountains of the intervening area will bring to light new localities for the plant, but the present known distribution for it is unusual.

13. A. Lyallii Watson. Perennial, caespitose; caudex usually branched; stems few to numerous, dwarfed at high altitudes, glabrous, 4–25 cm. high; basal leaves oblanceolate to narrowly linear-oblanceolate, acute to obtuse, entire, narrowly petioled, thin, entirely glabrous or pubescent with small dendritic trichomes, 1–3 cm. long, 3–6 mm. wide (1–2.5 mm. wide in var. *nubigena*); cauline leaves few, remote, lanceolate to oblong, acute, sessile, non-auriculate or sometimes slightly auricled, glabrous or the lower rarely pubescent, 1–2 cm. long, 3–6 mm. wide; sepals oblong, glabrous, non-saccate, green or sometimes purplish, 3.5–4.5 mm. long, about 1.5 mm. wide; petals spatulate, long and narrowly clawed, rose to purplish, (5–) 7–10 mm. long, (1.5–) 2–3 mm. wide; glandular tissue continuous beneath all stamens, moderately developed; siliques erect to slightly divergent, narrowed to a very short style or sessile stigma, one-nerved to the middle, glabrous, 3–5 cm. long, 2–3 mm. wide; seeds orbicular, winged, 1–2 mm. broad, uniseriate to imperfectly biseriate.

13a. Var. **typica.** *A. Lyallii* Watson in Proc. Am. Acad. **11:** 122 (1875) and in Gray, Syn. Fl. N. Am. **1:** 166 (1895); Brewer & Watson, Bot. Calif. **1:** 32 (1876); Greene, Fl. Francisc. 254

(1891); Howell, Fl. Northw. Am. **1:** 44 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906); Coulter & Nelson, New Man. Bot. Rky. Mts. 226 (1909); Rydberg, Fl. Rky. Mts. 359 (1917); Smiley in Univ. Calif. Pub. Bot. **9:** 205 (1921); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 40, fig. 12 (1936). *A. Drummondi* Gray, var. *alpina* Watson in King, Geol. Expl. Fortieth Parallel **5:** 18 (1871); Jepson, Fl. Calif. **2:** 64 (1936); Hopkins in Rhodora **39:** 140 (1937) excl. syn. *A. albertina*. *A. oreophila* Rydberg in Bull. Torr. Bot. Club **34:** 437 (1907) and Fl. Rky. Mts. 359 (1918). *A. armerifolia* Greene, Leaflets **2:** 75 (1910). *A. densa* Greene, ibid. p. 76. *A. multiceps* Greene, ibid. *A. Drummondi* Gray, var. *Lyallii* (Wats.) Jepson, Man. Fl. Pl. Calif. 429 (1925). *A. Drummondi* Gray, var. *oreophila* (Rydb.) Hopkins in Rhodora **39:** 141 (1937).—Alberta and Wyoming to California and British Columbia. Map 3. Alberta: head of Ptarmigan Valley, July, 1906, *Brown 385* (G); Mt. Temple, Laggan, Aug., 1904, *Butters, Holway & Rosendahl a7* (G); Lake O'Hara, Rky. Mt. Park, Aug., 1904, *Macoun 64509* (G); Lake Louise, Rky. Mt. Park, July, 1904, *Macoun 64510* (G, US). Montana: vicinity of Sexton Glacier, Glacier Park, Aug., 1919, *Standley 17224* (US); Logan Pass, Flathead Co., Aug., 1934, *Hodgdon & Rossbach 12 & 13* (G); Glacier Nat. Park, June, 1934, *Maguire et al. 15042* (UAC); MacDougal Peak, Mission Range, July, 1908, *Clemens s.n.* (G); Gallatin Peak, Aug., 1928, *Swingle s.n.* (RM). Wyoming: Union Peak, Aug., 1894, *Nelson 3154* (RM); near Yellowstone Lake, Aug., 1871, *Adams s.n.* (US); mts. near Cottonwood Lake, Lincoln Co., Aug., 1923, *Payson & Armstrong 3788* (G, RM); Teton Mts., Aug., 1894, *Nelson 1007* (US), July, 1901, *Merrill & Wilcox 1253* (US). Idaho: ridge south from Wiessners Peak, July, 1895, *Leiberg 1362* (G, O, RM, US); Packsaddle Peak, Kootenai Co., Aug., 1892, *Sandberg et al. 852* (US); junction of the Selway and Lochsa Rivers, Idaho Co., July, 1937, *Constance & Pennell 1991* (G, R); high ridge west of Cascade, Valley Co., July, 1937, *Thompson 13853* (G, R); Salmon River Mts., near Bonanza, Custer Co., July, 1916, *Macbride & Payson 3393* (G, RM, US); head of Boulder Cr., Sawtooth Mts., Blaine Co., Aug., 1937, *Thompson 14086* in part (R); Twin Lakes, about 11 miles southwest of Obsidian, Blaine Co., Aug., 1939, *Hitchcock & Martin 5727* (R). Utah: Henry's Fork Basin, Summit Co., Aug., 1936, *Maguire et al. 14711* (UAC); La Motte Peak, Uinta Mts., June, 1926, *E. B. & L. B. Payson 5043* (G, RM, US); divide between Big Cottonwood Cañon and Heber Valley, 1905, *Rydberg & Carlton 6678* (NY, type of *A. oreophila*); Twin Lakes, Salt Lake Co., Aug., 1906, *Garrett 1913* (US); Strawberry Valley, Wasatch Mts., Aug., 1883, *M. E. Jones s.n.* (US); White Pine Lake, Mt. Naomi

Region, Cache Co., July, 1936, *Maguire et al. 14091 & 14023* (UAC). Nevada: East Humbolt Mts. (Clover Mts.), Elko Co., Sept., 1868, *Watson 75* (G, type of *A. Drummondi*, var. *alpina*), Sept., 1910, *Heller 10231* (G); head of Lamoille Creek, about 15 miles southeast of Lamoille, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2547* (G, R). California: north side of Black Mt., near Kings Castle, Siskiyou Co., July, 1939, *Hitchcock & Martin 5303* (R); Susie Lake, Aug., 1909, *McGregor 132* (US); Gabbot Meadow, Alpine Co., June-July, 1913, *Eggleston 9419* (US); Mt. Dana, Tuolumne Co., July, 1935, *Sharsmith 2077* (UC); Rock Creek Lake Basin, Inyo Co., July, 1934, *Peirson 11295* in part (Peirs), Aug., 1933, *Peirson 10767* (Peirs). Oregon: Wallowa Mts., Wallowa Co., Aug., 1909, *Cusick 3381* (O, WSC); Eagle Cap, Union Co., Sept., 1907, *Sampson & Pearson 206* (US, type of *A. densa*); Blue Mts., head of Anthony Creek, July & Sept., 1899, *Cusick 2245* (G, UC, WSC); Gunsight Peak, near Anthony Lake, Baker Co., July, 1938, *Rollins & Chambers 2633* (G, R); Strawberry Mts., Grant Co., July, 1925, *Henderson 5579* (O); Mount Hood, July-Aug., 1886, *Howell 590* (G, O); middle peak of Three Sisters, July, 1914, *Peck 2723* (O); Mt. Thielson, Aug., 1897, *Coville & Applegate 435* (US, type; RM, isotype of *A. multiceps*); Crater Lake Nat. Park, Sept., 1902, *Coville 1504* (US, type of *A. armerifolia*); Johnson Prairie, Jackson Co., June, 1898, *Applegate 2458* (US). Washington: Fort Coville to the Rocky Mts., 1861, *Lyall s.n.* (G, type); Ashtnola, Cascade Mts., 1860, *Lyall s.n.* (G); Sheep Mt., Okanogan Co., July-Aug., 1916, *Eggleston 13299* (US); Indian Head Peak, Chelan Co., July, 1921, *St. John 4847* (WSC); Mount Baker, Whatcom Co., Aug., 1923, *St. John 5125* (WSC); Iron Mt., Kittitas Co., June, 1931, *Thompson 6645* (T); Mt. Rainier, Aug., 1897, *Allen 299* (G, UC, UW, WSC); Mt. Adams, Aug., 1882, *T. Howell 557* (G, marked "typical" by Watson); Olympic Mts., Aug., 1895, *Piper 2180* (G, WSC); Hurricane Ridge, Clallam Co., Sept., 1933, *Thompson 14183* (G, R). British Columbia: Green Mt., near Haylmore, July, 1938, *Thompson 677* (G); between Mt. Wapta and Mt. Field, 1919, *Walcott s.n.* (US).

13b. Var. **nubigena** (Macbride & Payson) comb. nov. Densely caespitose perennial with few to numerous filiform stems, 4–12 cm. high; basal leaves narrowly linear-oblanceolate, 1–1.5 cm. long, 1–2.5 mm. wide, acute, densely pubescent with fine dendritic trichomes to rarely glabrous; cauline narrowly linear; petals pink to purplish, 5–7 mm. long, 1.5–2.5 mm. broad; siliques acute.—*A. nubigena* Macbride & Payson in Contrib. Gray Herb. **49:** 62 (1917). *A. paupercula* Greene, Leaflets **2:** 77 (1910). *A. microphylla* Nutt., var. *nubigena* (Macbride & Payson) Rollins in Res. Stud. State Coll. Wash. **4:** 40 (1936).—California and Idaho: Smoky Mts., Blaine Co., Aug., 1916, *Macbride*

& *Payson 3772* (G, TYPE; RM, UC, US, isotypes); Josephus Lakes, Custer Co., Aug., 1916, *Macbride & Payson 3552* (G, RM); near Sawtooth, July, 1895, *Henderson 3535* (RM, US), July, 1896, *Evermann 656* (US); near Stanley Lake, Custer Co., July, 1937, *Thompson 13997* (T, R). CALIFORNIA: Farewell Gap, April-Sept., 1897, *Purpus 5229½* (US, TYPE; G, isotype of *A. paupercula*); Dana Plateau, Mono Co., July, 1936, *Mason 11417 & 11401B* (UC), Sept., 1936, *C. W. Sharsmith 2413* (G); White Mt., Tuolumne Co., July, 1936, *Mason 11351* (G); Mt. Dana, Tuolumne Co., July, 1933, *C. W. Sharsmith 133B* (UC), July, 1936, *C. W. Sharsmith 2206* (G); Folger Peak, Alpine Co., July, 1913, *Eggleston 9618 & 9641a* (US).

Jepson[1] and Hopkins[2] have recently treated *A. Lyallii* as a variety or varieties (var. *alpina* and var. *oreophila*) of *A. Drummondi.* Since the publications by these authors, I have had the opportunity of examining and comparing this species with *A. Drummondi* both in the field and from greenhouse cultures. At 9,500 feet in the Ruby Mountains of northern Nevada, *A. Lyallii* and *A. Drummondi* were found sharing the same shallow soil covering a granite outcrop. Plants of both species were about the same height (1–2 dm.), but could be readily distinguished when certain characters were carefully noted. In *A. Lyallii* the siliques were somewhat divergent, the seeds in a single row equaled the silique-width and the pubescence, if present, was of a multiple-branching type. *A. Drummondi* had strictly erect siliques, the seeds in two rows were only about half the silique-width and the pubescence, if present, was closely appressed and bifurcate (malpighiaceous). Specimens of *A. Lyallii* (*Rollins & Chambers 2547*) and of *A. Drummondi* (*Rollins & Chambers 2547a*) were collected to demonstrate these points. In the same locality in a more favorable habitat, taller plants of *A. Drummondi* were found (*Rollins & Chambers 2454*). These observations and others, along with a study of the whole question in the laboratory, have convinced me that *A. Lyallii* is not merely an alpine variety of *A. Drummondi* as sometimes supposed, but that it is a discrete biological entity which usually maintains its distinctive characters even when growing side by side with the latter species. In some localities, for example the Olympic Mts. and northern Cascade Mts. of western Washington, there is ap-

[1] Fl. Calif. **2**: 64 (1936).
[2] l. c. p. 140.

parently some crossing where the two species grow in the neighborhood of each other. An occasional plant from either of these areas shows intermediate characteristics between *A. Lyallii* and *A. Drummondi*, but determinations can ordinarily be decisive. In these areas, *A. Holboellii* seems also to cross occasionally with *A. Drummondi* giving a product not so different from a tall plant of *A. Lyallii.*

The pubescent phase of *A. Lyallii* was named *A. oreophila* by Rydberg and reduced to varietal rank under *A. Drummondi* by Hopkins. That the presence of pubescence alone in a supposedly glabrous species is not always taxonomically significant has been demonstrated in other species. In both places where I have collected *A. Lyallii* (northern Nevada and eastern Oregon), pubescent and glabrous plants grew together indiscriminately. That this is true nearly throughout the range of the species is shown by the constant occurrence of both pubescent and glabrous plants on the same sheet in a large percentage of the specimens examined, hence I can see no reason for separating the two nomenclaturally.

The type of *A. paupercula* Greene very well matches the type of *A. nubigena* of Macbride and Payson except that the latter has narrower and shorter leaves. However, other specimens from Idaho are identical in all details with the Sierra Nevada plants. Greene's name has priority as a specific epithet, but *A. nubigena* was first placed in a varietal category, hence the plants must be known as *A. Lyallii*, var. *nubigena.* This variety is also closely related to *A. microphylla* which it resembles in its basal leaves and pubescence. But the broadly winged seeds, nerved siliques and large flowers indicate its real homology to be with *A. Lyallii.* The large gap between central Idaho and the high Sierra Nevada of California makes the distribution of var. *nubigena* rather unusual. However, the range of the very distinctive crucifer, *Anelsonia eurycarpa* is almost identical and there are doubtless other plants with a similar disrupted range.

14 A. Drummondi Gray. Biennial or perennial; stems one to several from a simple caudex, simple or branched above, glabrous to very sparingly appressed-pubescent at base, 3–9 dm. high; basal leaves narrowly oblanceolate to somewhat broader, entire to dentate, petiolate, usually acute, glabrous to pubescent with malpighiaceous trichomes, 2–8 cm. long; cauline leaves oblong to oblong-

lanceolate, acute, sessile, auriculate, usually clasping, glabrous, crowded toward base, fewer above, entire to sparingly dentate, 2–7 cm. long; flowers erect; sepals narrowly oblong, obtuse, glabrous, 3–5 mm. long; petals white to pinkish, 7–10 mm. long; stamens barely exceeding the calyx; pedicels erect, glabrous, 1–2 cm. long; siliques erect, often strict, straight, usually numerous and crowded, glabrous, 4–10 cm. long, 1.5–3 mm. wide, obtuse or rarely subacute; valves 1-nerved to the top or at least above middle; style short or lacking; seeds oblong to slightly broader, prominently winged on distal end and on one side, narrowly winged or wingless on the other side, about 1 mm. wide, 1.5–2 mm. long, biseriate.—Proc. Am. Acad. **6:** 187 (1866) and Man. ed. 5. 69 (1869); Watson in King, Geol. Expl. Fortieth Parallel **5:** 17 (1871) in part; Watson in Gray, Syn. Fl. N. Am. **1:** 166 (1895) in part; Britton & Brown, Ill. Fl. **2:** 150 (1897) in part; Fernald in Rhodora **5:** 230 (1903); Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906); Robinson & Fernald in Gray, Man. ed. 7. 437 (1908); Coulter & Nelson, New Man. Bot. Rky. Mts. 226 (1909); Henry, Fl. So. Brit. Columb. 150 (1918); Rydberg, Fl. Rky. Mts. 359 (1918) and Fl. Pr. Pl. Cent. N. Am. 381 (1932); Jepson, Man. Fl. Pl. Calif. 429 (1925) in part, and Fl. Calif. **2:** 63 (1936) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 43, fig. 13 (1936); G. N. Jones in Univ. Wash. Pub. Biol. **7:** 90 (1939). *A. Drummondi* Gray, var. *typica* Hopkins in Rhodora **39:** 136 (1937). *Turritis stricta* Graham in Edinb. New Phil. Journ. 350 (1829); Hooker, Fl. Bor.-Am. **1:** 40 (1829); Torrey & Gray, Fl. N. Am. **1:** 79 (1838); Gray, Man. 36 (1848) and Gen. Illustr. **1:** 144, t. 59 (1848), not *Arabis stricta* Hudson, Fl. Angl. **1:** 292 (1777). *Streptanthus angustifolius* Nuttall in T. & G., Fl. N. Am. **1:** 76 (1838), not *Arabis angustifolia* Lam., Encycl. **1:** 220 (1883). *Arabis confinis* Watson in Proc. Am. Acad. **22:** 466 (1887) in part and in Gray, Syn. Fl. N. Am. **1:** 163 (1895) in part; Rydberg, Fl. Pr. Pl. Cent. N. Am. 381 (1932). *Erysimum Drummondi* (Gray) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891). *A. connexa* Greene in Pitt. **4:** 197 (1900); Rydberg, Fl. Rky. Mts. 359 (1918) and Fl. Pr. Pl. Cent. N. Am. 381 (1932). *A. Drummondi* Gray, var. *connexa* (Greene) Fernald in Rhodora **5:** 231 (1903); Robinson & Fernald in Gray, Man. ed. 7. 437 (1908); Hopkins in Rhodora **39:** 144 (1937). *A. oxyphylla* Greene in Pitt. **4:** 196 (1900). *A. Drummondi* Gray, var. *oxyphylla* (Greene) Hopkins, op. cit. p. 143. *A. albertina* Greene in Pitt. **4:** 196 (1900). *A. philonipha* Nelson ex Rydberg, Fl. Colorado 165 (1906), *nomen nudum*. *Turritis Drummondi* (Gray) Lunell in Am. Midl. Natur. **5:** 236 (1918).—Southern Labrador, Newfoundland and adjacent Quebec south to Delaware and west through the Great Lakes Region

to California, Washington and British Columbia.[1] MAP 4. WITHOUT DEFINITE LOCALITY: Rocky Mts., *Nuttall s.n.* (G, NY, isotypes of *Streptanthus angustifolius*); Rocky Mts., 1858, *Bourgeau s.n.* (G). ALBERTA: Elbow River, Rocky Mts., June–July, 1897, *J. Macoun 18101* (ND, TYPE of *A. albertina;* photo at Gray Herb.); Waterton Lake, July, 1895, *Macoun A1002* (G); Cypress Hills, June, 1894, *Macoun 3071* (G); Maligne Lake, July, 1908, *Brown 1257* (G); base of Mt. Wilson, June, 1908, *Brown 999* (G). SOUTH DAKOTA: near Savoy, Black Hills National Forest, June, 1910, *Murdoch 4117* (G). MONTANA: Logan Pass, Glacier Park, Aug., 1934, *Hodgdon & Rossbach 3* (G); 12 miles northwest of Wilsall, July, 1921, *Suksdorf 1053* (G, WSC); Bridger Mts., July, 1897, *Rydberg & Bessey 4209* (G); near Melrose, Beaverhead Co., *Bradley 29* (T). WYOMING: base of Beartooth Peak, Park Co., July, 1939, *Rollins & Muñoz 2849* (G, R); Medicine Mt., Big Horn Co., *L. O. & R. Williams 3249* (G, R); Soda Butte Cr., Yellowstone National Park, July, 1899, *A. & E. Nelson 5827* (G, RM); 8 miles west of Wind River, Fremont Co., June, 1936, *Costello & Rollins 2065* (G, R); near Continental Divide, west of Encampment, Sierra Madre, Carbon Co., July, 1936, *Ownbey 1077* (R); Telephone Mines, Albany Co., Aug., 1900, *Nelson 7913* (G, isotype of *A. philonipha*); University of Wyoming Summer Camp, Medicine Bow Mts., Albany Co., July, 1935, *Rollins 1050* (G, R); Vedawoo Glenn, Laramie Hills, July, 1935, *Rollins 991a* (G, R); 15 miles south of Mountain View, Uinta Co., June, 1938, *Rollins & Gates 2372* (G, R). COLORADO: 20 miles north of Rifle, Rio Blanco Co., May, 1938, *Rollins 2204* (G, R); Denver Camp, Willow Creek Pass, Grand Co., July, 1935, *Rollins 1028* (G, R); Beaver Creek, Larimer Co., July, 1903, *Goodding 1446* (G); Empire ?, Clear Creek Co., 1875, *E. L. Greene s.n.* (ND, TYPE of *A. oxyphylla;* photo in Gray Herb.); 4 miles north of Como, Park Co., Aug., 1937, *Beetle 2214* (R); 5 miles south of Tincup, Gunnison Co., July, 1936, *Rollins 1439* (G, R); 6 miles northwest of Rio Grande Reservoir, Hinsdale Co., Aug., 1936, *Rollins 1506* (G, R); 30 miles southwest of Montrose, Montrose Co., Aug., 1937, *Rollins 1979* (G, R); near Pagosa Peak, Mineral Co., Aug., 1899, *Baker 341* (ND, TYPE; G, isotype of *A. connexa*). NEW MEXICO: Costilla Park, Taos Co., Sept., 1895, *Mrs. O. St. John 58* (G); Grass Mt., Pecos River Nat. Forest (now the Santa Fe Nat. Forest), June, 1908, *Standley 4069* (G). IDAHO: divide between St. Joe and Clearwater River, July, 1895, *Leiberg 1212* (G, RM); near Bonanza, Custer Co., July, 1916, *Macbride & Payson 3426* (G, M, UC, US); above Redfish Lake, Aug., 1916, *Macbride & Payson 3659* (G, M, RM); Cherry Creek Divide,

[1] For citations of specimens from east of the one-hundredth meridian see Hopkins, op. cit. pp. 137–139.

Custer Co., July, 1939, *Davis 1554* (G, R); Wild Horse Creek, Custer Co., July, 1939, *Davis 1207* (R); Frazier Dam, Clark Co., June, 1938, *Davis 338* (G, R); Galena Pass, Blaine Co., June, 1938, *Davis 448* in part (R). Utah: Big Cottonwood Canyon, Salt Lake Co., July, 1905, *Garrett s.n.* (G); Alta, Wasatch Mts., Aug., 1879, *M. E. Jones 1177* (G); Stillwater Fork, Uinta Mts., Summit Co., July, 1926, *E. B. & L. B. Payson 4980* (G); 30 miles south of Manila, Uintah Co., June, 1937, *Rollins 1764* (G); above White Pine Lake, Bear River Range, Cache Co., *Maguire & Hobson 14221* (G); near Delano, Beaver Co., July, 1934, *Hodgdon & Rossbach 71* (G); La Sal Mts., Grand Co., July, 1924, *E. B. & L. B. Payson 3945* (G); West Mt., Abajo Mts., San Juan Co., June, 1932, *Maguire & Redd 1853* (UAC); Blue Spring Ranger Station, Sevier Forest, Garfield Co., July, 1912, *Eggleston 8389* (NA). Arizona: North Rim, Grand Canyon of the Colorado, June, 1933, *Eastwood & Howell 967* (G). Nevada: Hinkey Summit, Santa Rosa Range, Humboldt Co., July, 1937, *Train 281* (R); base of Mt. Wheeler, White Pine Co., July, 1938, *Rollins & Chambers 2486* (G, R); 3 miles south of Preston, White Pine Co., June, 1937, *Moore & Franklin 716* (NA, R); head of Lamoille Creek, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2545* (G, R); 8 miles west of North Fork, Elko Co., July, 1937, *Nichols & Lund 301* (R). California: Eagle Meadow, Tuolumne Co., July, 1936, *Hoover 1476* (R); Mono Pass, Tuolumne River, 1863, *Brewer s.n.* (G); Tioga Crest, Sierra Nevada, Mono Co., July, 1936, *Mason 11464* (UC); Virginia Lakes Basin, Mono Co., July, 1934, *Peirson 11233* (Peirs); South Lake, Bishop Creek, Inyo Co., July, 1929, *Peirson 8517* (Peirs). Oregon: Elk Horn Mts., west of North Powder, Baker Co., Aug., 1915, *Peck 2710* (W); base of Gunsight Peak, Blue Mts., Baker Co., July, 1938, *Rollins & Chambers 2630* (G, R). Washington: Angels Pass, Okanogan Co., June, 1931, *Thompson 7044* (G); Heliotrope Ridge, Mt. Baker, Aug., 1937, *Muenscher 7883* (G); Sourdough Mt., Whatcom Co., Aug., 1937, *Muenscher 7884* (G); Stevens Pass, Aug., 1893, *Sandberg & Leiberg 764* (WSC); White River, Mount Rainier Park, June, 1937, *G. N. Jones 10002* (G); north of Mt. Adams, Aug., 1892, *Henderson 2397* (G, UW); Mt. Angeles, Clallam Co., July, 1931, *Thompson 7427* (G), July, 1931, *J. T. Howell 7471* (G); Mount Constance, Jefferson Co., Aug., 1938, *Rollins & Chambers 2652* (G, R, DS). British Columbia: Bluster Mt., Marble Mts., July, 1938, *J. & E. Thompson 404* (G); Cornwall Hills, July, 1894, *McEvoy 5097* (G); Emerald Lake, June, 1929, *Peterson 52* (G); Mount St. Thomas, Aug., 1902, *Macoun 63499* (G); Lake Atlin, July, 1914, *Eastwood 638* (Cl, G); Mt. Selwyn, July, 1932, *Raup & Abbe 4081* (G).

The unreliability of the presence or absence of pubescence

as a criterion for the separation of certain species and varieties of *Arabis* has been stressed above, but this point must be particularly emphasized in the case of *A. Drummondi.* This wide-ranging species tends toward a glabrous condition in the eastern portion of its range, while the dominant form along the Rocky Mountain axis has strigose basal leaves. However, it is significant that one finds specimens possessing strigose trichomes from scattered stations in Massachusetts, Connecticut, Vermont, New York, Michigan and Ontario in the eastern half of North America. Westward, where the strigose form prevails, glabrous plants are also abundant and may be found throughout most of the Rocky Mountain region. The sporadic occurrence of pubescent forms nearly throughout the range of *A. Drummondi* is not, in my opinion, taxonomically significant. This character appears to be dependent upon the age of the plant and the environmental circumstances under which it grew. These two points were studied in several greenhouse- and two field-cultures obtained from seeds of *A. Drummondi* gathered in Colorado (*Rollins 1506*). The young leaves under both greenhouse and field conditions were evenly strigose on both surfaces. On greenhouse-grown plants the trichomes remained evenly spaced over the leaf-surfaces on fully matured or even old basal leaves, although the distance between trichomes was considerably greater than on young leaves. The mature basal leaves of field-cultures behaved differently with respect to vestiture. Here, the older basal leaves became completely glabrous or a few hairs remained along the leaf-margins. The pubescence had evidently been shed. Assuming that the same thing takes place in nature and in view of the fact that the pubescent form of *A. Drummondi* has no distinctive geographic range of its own, I find it desirable to discontinue *A. oxyphylla* Greene as a taxonomic entity even in varietal rank as Hopkins, op. cit. p. 143, placed it.

A broad-podded form of *A. Drummondi* was segregated as *A. connexa* by Greene and has more recently been maintained in varietal rank. This form occurs at widely separated locations in the range of the species and is doubtfully a natural biological entity. The broad-podded form of *A. Drummondi* represents the one extreme in pod-width and should be more naturally included as an integral part of the species proper rather than as

a variety of it. My collection, number 1439 from Gunnison County, Colorado, was purposely selected from a colony of broad-podded plants to illustrate this form. In the dry meadow from which these plants came nearly the complete range of pod-width found in *A. Drummondi* might have been collected from the various colonies present. Field observations indicate that the broad-podded forms and the noticeably narrow-podded forms tend to grow in colonies, hence, pod-size appears to be genetically controlled. This does not mean that the factors controlling all degrees of pod-size are lacking in plants with one extreme or the other. Plants with extreme pod-width, since they are of random occurrence, may be due to some type of genetical segregation.

The great variation in the size of the gross morphological structures in *A. Drummondi* is partially due to its aggressive nature, at least in western America. The species is quick to inhabit disturbed soils, where it becomes abnormally large and vigorous. In western America the flowers are usually white, but may be tinged with pink. Flowering specimens with pink or purple flowers which seem to belong to *A. Drummondi* are apt to prove to be *A. Lyallii* or *A. divaricarpa* upon closer examination.

15. A. divaricarpa A. Nelson. Biennial or rarely perennial; stems one or few from a simple or branching caudex, simple or branched above, pubescent below with appressed trichomes or glabrous throughout (except in var. *interposita* which is pubescent both above and below), 3–9 dm. high; basal leaves broadly oblanceolate to narrowly spatulate, usually acute, dentate to subentire, loosely pubescent with three- to several-rayed trichomes, pubescence usually appressed, 2–6 cm. long, 4–8 mm. wide; cauline leaves narrowly oblong to lanceolate, entire or the lower sometimes dentate, glabrous or the lower sparsely pubescent (except in var. *interposita* which often has all the leaves sparsely pubescent), auriculate and often sagittate; sepals oblong, glabrous to sparsely pubescent, scarious-margined, 3–5 mm. long; petals spatulate, pink to purplish, 6–10 mm. long; pedicels divaricate to loosely descending, slender, glabrous (pubescent in var. *interposita*), 6–12 mm. long; siliques straight or rarely very slightly curved, loosely ascending, divaricate or less frequently nearly pendulous, glabrous, nerved to middle or nearly entire length, 2–8 cm. long, 1.5–2.5 mm. wide; style very short or absent; seeds broadly oblong to nearly orbicular, narrowly winged, about 1 mm. wide, uniseriate or imperfectly biseriate.

Pedicels and upper stems glabrous, lower stems glabrous to sparsely pubescent with malpighiaceous trichomes.......15a. Var. *typica.*
Pedicels and upper stems usually pubescent with three- to four-parted trichomes, lower stems pubescent with several-branched trichomes..............................15b. Var. *interposita.*

15a. Var. TYPICA Hopkins in RHODORA **39:** 130 (1937). *A. divaricarpa* A. Nelson in Bot. Gaz. **30:** 193 (1900); Coulter & Nelson, New Man. Bot. Rky. Mts. 226 (1909); Rydberg, Fl. Rky. Mts. 362 (1918); Tidestrom in Contrib. U. S. Nat. Herb. (Fl. Utah and Nevada) **25:** 244 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 45 (1936). *Turritis brachycarpa* T. & G., Fl. N. Am. **1:** 79 (1838); Walpers, Rep. **1:** 130 (1842); Gray, Man. 37 (1848). *Arabis Drummondi*, var. *brachycarpa* (T. & G.) Gray, Man. ed. 5. 69 (1867). *A. confinis* Watson in Proc. Am. Acad. **22:** 466 (1887) in part and in Gray, Syn. Fl. N. Am. **1:** 163 (1895) in part. *A. confinis*, var. *brachycarpa* (T. & G.) Watson & Coulter in Gray, Man. ed. 6. 67 (1889); Watson in Gray, Syn. Fl. N. Am. **1:** 163 (1895). *A. brachycarpa* (T. & G.) Britton in Mem. Torr. Bot. Club **5:** 174 (1894); Fernald in RHODORA **5:** 231 (1903); Robinson & Fernald in Gray, Man. ed. 7. 437 (1908); Rydberg, Fl. Rky. Mts. 361 (1918) and Fl. Pr. Pl. Cent. N. Am. 381 (1932); Marie-Victorin, Fl. Laurent. 261 (1935); not *A. brachycarpa* Ruprecht, Fl. Cauc, 73 (1869). *A. oblanceolata* Rydberg in Bull. Torr. Bot. Club **31:** 557 (1904); Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909); Rydberg, Fl. Rky. Mts. 359 (1918). *A. pratincola* Greene in Fedde, Repert. Nov. Sp. **5:** 344 (1908). *A. Drummondi*, var. *pratincola* (Greene) Hopkins in RHODORA **39:** 142 (1937). *A. nemophila* Greene, Leaflets **2:** 78 (1910). *A. dacotica* Greene, ibid. p. 80. *A. brevisiliqua* Rydberg, Bull. Torr. Bot. Club **39:** 326 (1912). *A. Stokesiae* Rydberg, Fl. Rky. Mts. 361 (1918).—Quebec[1] to northern New York, Great Lakes region, interruptedly westward to the Rocky Mountains and California, north to Yukon and Alaska. MAP 7. SASKATCHEWAN: without locality, 1858, *E. Bourgeau s.n.* (G); vicinity of Charlot Point, Lake Athabaska, June, 1935, *Raup 6111* (G); Cypress Hills, June, 1894, *J. Macoun 3072* (G). ALBERTA: vicinity of Fort Chipewyan, June, 1935, *Raup 6068* (G), *Raup 6067* (G); Rosebud Valley, May, 1915, *Moodie 855* (G); discharge of Lake Louise, July, 1904, *J. Macoun 64514* (G, M, NY); below Wapta Lake, Rky. Mt. Park, Aug., 1904, *J. Macoun 64513* (G, NY); Laggan, Rky. Mt. Park, June, 1904, *J. Macoun 64518* (G); shore of Waterton Lake, July, 1895, *J. Macoun A1004* (G); opposite Cataract Pass, headwaters of the Saskatchewan and Athabasca Rivers, June, 1908, *Brown 1044* (G). SOUTH DAKOTA: near Deadwood, Lawrence Co.,

[1] For citations of specimens from east of the one-hundredth meridian see Hopkins, op. cit. pp. 130–132.

June, 1929, *Palmer 37164* (G); Custer Peak, Black Hills, 1927, *Hayward 1749* (F); Fort Meade, May, 1887, *Forwood 28* (US, TYPE; G, isotype of *A. dacotica* Greene). MONTANA: Glacier Park, July, 1931, *Pease 22328* (G); about 13 miles west of Browning, Glacier Co., Aug., 1934, *Hodgdon & Rossbach 72* (G); Daly Creek, Granite Co., Aug., 1933, *C. L. Hitchcock 2067* (G); Missoula, May, 1921, *Kirkwood 1130* (Cl); Bozeman, June, 1900, *Blankinship s.n.* (M); near Wilsall, Park Co., July, 1921, *Suksdorf 531* (G, R); West Yellowstone, Gallatin Co., July, 1920, *E. B. & L. B. Payson 1925* (G, RM); 10 miles southwest of Red Lodge, Carbon Co., July, 1939, *Rollins & Muñoz 2819* (G, R). WYOMING: Yellowstone Lake, Yellowstone National Park, Aug. 6, 1899, *A. & E. Nelson 6332* (RM, TYPE), Aug 23, 1899, *A. & E. Nelson 6622* (G); 5 miles west of Beartooth Lake, Park Co., July, 1939, *Rollins & Muñoz 2858* (G, R); Jackson's Hole, Lincoln Co., Aug., 1920, *E. B. & L. B. Payson 2194* (G, RM); near Afton, Lincoln Co., July, 1923, *Payson & Armstrong 3367* (G); Newcastle, Weston Co., June, 1893, *Bates s.n.* (G); 7 miles northwest of Hulett, Crook Co., June, 1935, *Ownbey 551a* (G); Centennial, Albany Co., July, 1902, *Nelson 8735* (G). COLORADO: Spicer, Larimer Co., July, 1903, *Goodding 1513* (G); eastern slope of Fall River Pass, Rocky Mountain National Park, Aug., 1937, *Rollins 1884* (G, R); East Tennessee Cr., about 10 miles north of Leadville, Lake Co., July, 1936, *Rollins 1401* (G, R); western slope of Monarch Pass, 1 mile from summit, Chaffee Co., July, 1936, *Rollins 1343* (G, R); 2 miles south of Pitkin, Gunnison Co., July, 1936, *Rollins 1426a* (G); near the Alvrado Ranger Station, Custer Co., June, 1936, *Rollins 1245* (G, R); lower slope of Mt. Carbonate, 20 miles west of Gardner, Huerfano Co., June, 1936, *Rollins 1258* (DS, G, R); mountains above Silverton, San Juan Co., July, 1934, *Hodgdon & Rossbach 7* (G); Valley Spur, Sept., 1901, *Underwood & Selby 454* (NY, TYPE of *A. oblanceolata*); Ridgway, Ouray Co., June, 1924, *E. B. & L. B. Payson 3850* (G, M). IDAHO: ridges south from Wiessners Peak, Kootenai Co., July, 1895, *Leiberg 1374* (G, M); Lookout, Priest River Experiment Station, July, 1923, *Epling 5872* (UCLA); Lolo Trail, Idaho Co., July, 1937, *Constance & Pennell 2020* (G, R); Birch Creek, Lemhi Co., June, 1939, *Davis 1098* (R); Frazer Dam, Clark Co., June, 1938, *Davis 340* (R); Henry Lake, Fremont Co., July, 1920, *E. B. & L. B. Payson 1984* (G); near Clayton, Custer Co., July, 1916, *Macbride & Payson 3386* (G, RM, UC); near Clyde, Blaine Co., July, 1916, *Macbride & Payson 3136* (G, RM, US); Meadow Creek Ranger Station, Bear Lake Co., June, 1936, *Davis 395* (R). UTAH: inlet to White Pine Lake, Mt. Naomi region, Cache Co., July, 1936, *Hoyt 15267* (G, R); Stillwater Fork, Uinta Mts., Summit Co., July, 1926, *E. B. & L. B. Payson 4967* (G); 25 miles south of

Manila, Uintah Co., June, 1937, *Rollins 1767* (DS, G, R); 18 miles north of Vernal, Uinta Mts., Uintah Co., June, 1937, *Rollins 1760a* (DS, G, R); Parley's Canyon, Wasatch Mts., June, 1901, *S. G. Stokes s.n.* (NY, TYPE of *A. Stokesiae*). NEVADA: West Humboldt Mts., June, 1886, *Watson 74 ?* in part (G); head of Lamoille Creek, about 15 miles southeast of Lamoille, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2546* (G, R); Jack Creek, 70 miles northwest of Elko, Elko Co., June, 1937, *Nichols & Lund 213* (R); 1 mile south of Marlette Lake, Sierra Nevada Range, Ormsby Co., July, 1939, *Train 3213* (G); Spooner, Douglas Co., June, 1902, *Baker 1149* (G, M, isotypes of *A. pratincola*). CALIFORNIA: rocky gulch off Jaynes Canyon, Siskiyou Mts., Siskiyou Co., Aug., 1934, *Wheeler 3053* (G); south fork of Salmon River, near Big Flat, Siskiyou Co., July, 1937, *J. T. Howell 13205* (G, R); near Castle Peak, Nevada Co., July, 1903, *Heller 7069* (G, M, NY, US); White's Creek Lake, Trinity Co., Aug., 1935, *Tracy 14692½* (UC); Donner Pass, Placer Co., July, 1919, *Heller 13319* (G); near Lake Alpine, Alpine Co., July, 1935, *Peirson 11573* (Peirs); Wheats Meadow Ranger Station, Stanislaus Forest, Tuolumne Co., June, 1918, *Eggleston 9282* (NA); east slope of Sonora Pass, July, 1932, *Peirson 10380* (Peirs); Rock Creek Lake Basin, Inyo Co., July, 1932, *Peirson 9456* (Peirs); Farewell Gap, Tulare Co., Aug., 1904, *Culbertson 4523* (G, M); near Mineral King, Tulare Co., Aug., 1891, *Coville & Funston 1450* (G); Sequoia National Forest, July, 1908, *A. Davidson 1847* (US, TYPE of *A. nemophila*). OREGON: Powder River Mts., Aug., 1896, *Piper 2507* (G, WSC); Strawberry Mt., Grant Co., July, 1925, *Henderson 5579* (G); Pine Creek, Baker Co., Aug., 1915, *Peck 2706* (W); head of Divine Creek, Steens Mts., June, 1901, *Cusick 2570* (G); 10 miles south of McKenzie Bridge, Lane Co., July, 1914, *Peck 2708* (G); Sparks Lake, Deschutes Co., July, 1931, *J. T. Howell 7139* (G); Ashland Butte, July, 1886, *Henderson 13* (G); near Lake-of-the-woods, Klamath Co., July, 1936, *Thompson 13138* (R). WASHINGTON: Godman Springs, Columbia Co., July, 1935, *Constance et al. 1178* (G, R, WSC); above Slate Creek, Barron, Whatcom Co., June, 1939, *Muenscher 10089* (G); Chiwaukum Cr., Chelan Co., Aug., 1916, *Eggleston 13534* (US); Table Mt., Kittitas Co., Aug., 1933, *Thompson 9778* (NY); Wenas Cattle Camp, Kittitas Co., July, 1937, *Caples & Spence 74* (FS); American River Canyon, above Union Creek, Yakima Co., June, 1936, *Eastwood & Howell 2983* (R); Cowlitz Ridge, Mt. Rainier, Pierce Co., Aug., 1919, *Flett 3162* (WSC). BRITISH COLUMBIA: Skagit Valley, July, 1905, *Macoun 70824* (G); July 6, 1905, *Macoun 70825* (NY, TYPE of *A. brevisiliqua*); near Lake Bootahnie, Marble Mts., June, 1938, *J. W. & E. M. Thompson 65* (G); Carson Mt., Marble Mts., June, 1938, *J. W. & E. M.*

Thompson 330 in part (G). Yukon: Dawson, June, 1914, *Eastwood 246* (G); Fort Selkirk, June, 1899, *Gorman 1008* (Can). Alaska: Mt. McKinley National Park, June, 1937, *Scamman 633* (G, L, R); between Anchorage and Curry, June, 1937, *Scamman 568* (G); between miles 52 and 65, Richardson Highway, *Anderson 1972* (L); Matanuska, *Anderson 1105* (L); Robertson River, June, 1921, *Murie 101* (L).

15b. Var. **interposita** (Greene), comb. nov. Stems usually simple, single, pubescent to the inflorescence; pedicels sparsely pubescent; siliques nerveless or nearly so.—*A. interposita* Greene, Leaflets **2:** 78 (1910). *A. acutina* Greene, ibid. p. 82. *A. Drummondi* Gray, var. *interposita* (Greene) Rollins in Res. Stud. State Coll. Wash. **4:** 45 (1936).—Southwestern Oregon and northern California. California: Spirit Lake, Marble Mts., Siskiyou Co., Aug., 1939, *J. T. Howell 14952* (G, R); Marble Mt., Siskiyou Co., June, 1901, *Chandler 1630* (UC); Log Lake, Siskiyou Co., June, 1910, *Butler 1537* (P); Caribou Basin, Siskiyou Co., July, 1937, *J. T. Howell 13551* (G, R); Trinity Summit, Humboldt Co., July, 1932, *Tracy 10396* (G, P). Oregon: Diamond Lake, Douglas Co., June, 1931, *J. T. Howell 6857* (G); Ashland Butte, Siskiyou Mts., and Crater Lake, Cascade Mts., July 14, Aug. 22, 1902, *Cusick 2970* (US, type as to plant in center of sheet; G, isotype as to plant on left of sheet); Crater Lake National Park, Aug., 1916, *Heller 12630* (G); Mt. Thielson, Aug. 6, 1897, *Coville & Leiberg 343* (US, type; RM, isotype of *A. acutina*); near Oregon Caves, July, 1918, *Peck 8276* (G, W).

The distribution of *A. divaricarpa* parallels in a general way that of *A. Drummondi* and these two species are very closely related. In fact, the relationship is so close that some natural hybridization apparently occurs. In the main, each species has a characteristic type of pubescence, but on occasional specimens a mixture of malpighiaceous and more highly branched hairs is found. These specimens usually resemble *A. divaricarpa* and are often so determined. However, other traces of "*Drummondi*" besides pubescence are frequently found, such as broader and more erect siliques and a tendency to have the seeds in two rows instead of the usual single row. *A. divaricarpa* is extremely variable as regards the position of the mature silique. Ordinarily the siliques diverge upward from the rachis at an angle of about 45°, but variations from nearly erect to a widely pendulous position are frequent. Different plants of *A. divaricarpa* possess trichomes of different sizes and specimens may

be arranged in two series on the basis of coarseness or fineness of the pubescence. This difference in trichome-size, together with the knowledge that polyploidy is found in the species, led to the investigation of size of pollen-grains in the two series, but no appreciable differences could be detected. No attempt was made to correlate stoma-size or -distribution with trichome-size in this species, although the accumulation of such data together with chromosome-counts on a selected series of plants would probably be profitable.

Two collections from Michigan, *Fernald & Pease 3334* and *Pease & Ogden 25181*, are notable because the silique-position is similar to that of *A. Holboellii* in being loosely descending and often secund. The superficial resemblance of these plants to *A. Holboellii* led Hopkins, op. cit. pp. 171 and 174, to attribute this species to the Keweenaw Peninsula of Michigan. A careful examination of the two collections shows that the pubescence is exactly the same as on other specimens of *A. divaricarpa* from the same area and is quite different from that of *A. Holboellii*. Pubescence-type is far more significant than pedicel- or silique-orientation in *Arabis* generally, hence one must conclude that the plants in question are actually *A. divaricarpa* instead of *A. Holboellii* as determined by Hopkins.

In another paper on *Arabis*, op. cit. p. 45, I treated certain plants of southern Oregon as *A. Drummondi*, var. *interposita*. These plants were later partly included by Hopkins, op. cit. p. 142, in *A. Drummondi*, var. *pratincola*. This separation from typical *A. Drummondi* was made because the stems and leaves were pubescent with several-branched hairs instead of being glabrous or pubescent with appressed bifurcate trichomes. In reconsidering the plants, I find that while they are somewhat intermediate between *A. Drummondi* and *A. divaricarpa*, they are really more closely related to the latter species and constitute a variety with more pubescent stems, pubescent pedicels and more erect siliques. *A. pratincola* is too near typical *A. divaricarpa* to be included in the variety.

16. A. FRUCTICOSA A. Nelson. Perennial; stems numerous from a branching base, glabrous and glaucous, abundantly branched, 4–6 dm. high; basal leaves oblanceolate to spatulate, obtuse to acute, not rounded at apex, rather sharply dentate to rarely entire, about 2 cm. long, 4–7 mm. wide, sparsely pubescent with

minute dendritic trichomes; cauline leaves glaucous, ovate to broadly oblong, sessile, auriculate, remote, 10–15 mm. long, 4–7 mm. wide, lower sparsely pubescent, dentate, upper entire and glabrous; sepals oblong, sparsely pubescent to glabrous, 2–3 mm. long; petals pink to purplish, spatulate, 5–7 mm. long; pedicels divaricately descending, glabrous, 6–10 mm. long; siliques glabrous and glaucous, divaricately spreading, straight to slightly curved, nerveless to slightly nerved near base, 4–6 cm. long, 1.5–2 mm. wide; seeds orbicular, narrowly winged, uniseriate, about 1.5 mm. broad.—Bot. Gaz. **30:** 190 (1900); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 362 (1918).—Wyoming: Undine Falls, Yellowstone National Park, July 6, 1899, *A. & E. Nelson 5681* (RM, type; G, NY, isotypes).

A. fructicosa is known only from the type collection, hence the normal range of variation cannot be determined. The species is apparently related to *A. divaricarpa* from which it is distinguished by having ovate instead of oblong cauline leaves, a much-branched caudex in place of a simple base and minute dendritic trichomes on the basal leaves instead of having them coarse and few-branched. *A. fructicosa* has some of the features of *A. Lemmoni*, var. *drepanoloba*, but the two are apparently not closely related. In the summer of 1939, attempts were made to re-collect *A. fructicosa* in Yellowstone National Park, but the species could not be found. However, the exact type station was not visited.

17. A. **rigidissima,** sp. nov. Herba perennis basi suffruticosa; caulibus glabris vel inferne sparse pubescentibus, 2–4 dm. altis; foliis radicalibus glabris vel sparse pubescentibus spathulatis integris obtusis 1.5–3 cm. longis, 4–8 mm. latis; foliis caulinis ovatis vel oblongis sessilibus auriculatis integris glabris 1–2 cm. longis, 4–8 mm. latis; sepalis glabris oblongis 4–5 mm. longis 1.5–2 mm. latis; petalis spathulatis roseis 7–9 mm. longis; pedicellis glabris divaricato-adscendentibus 5–10 mm. longis; siliquis divaricato-adscendentibus glabris acuminatis 5–7 cm. longis, 2.5–3.5 mm. latis; seminibus oblongis vel orbicularibus alatis 2–2.5 mm. latis, uniseriatis.

Perennial; stems one to several from a naked simple or branching suffruticose caudex, sparingly pubescent below or glabrous throughout, simple or branched below, 2–4 dm. high; basal leaves spatulate, entire, obtuse, short-petioled, sparsely pubescent with rather fine dendritic or forked, spreading trichomes or usually glabrous, 1.5–3 cm. long, 4–8 mm. wide; cauline leaves ovate to oblong, sessile, auriculate, entire, coriaceous, usually

remote, glabrous or the lower rarely sparsely pubescent, 1–2 cm. long, 4–8 mm. wide; sepals glabrous, oblong, scarious-margined, 4–5 mm. long, 1.5–2 mm. broad, outer pair very slightly saccate; petals spatulate, tapering gradually to a fairly broad claw, pink, 7–9 mm. long, 2.5–3.5 mm. broad; glands well developed, continuous beneath all stamens; pedicels glabrous, divaricately ascending, 5–10 mm. long; siliques straight, divaricately ascending, glabrous, strongly nerved to the middle or slightly above, acuminate, 5–7 cm. long, 2.5–3.5 mm. wide; style less than 1 mm. long; seeds slightly oblong to orbicular, narrowly winged, 2–2.5 mm. broad, uniseriate.—Northwestern CALIFORNIA: Mary Blaine Mt., Trinity Co., Aug. 3, 1935, *J. P. Tracy 14469* (G, TYPE; UC, isotype); head of White's Creek, Devils Canyon Mts., Trinity Co., Aug., 1935, *Tracy 14536* (R, UC); White's Creek Lake, Devils Canyon Mts., Trinity Co., Aug., 1935, *Tracy 14668½* (UC); Trinity Summit, head of Devils Hole, Humboldt Co., July, 1935, *Tracy 14319½* (UC).

The siliques of *A. rigidissima* resemble those of *A. suffrutescens* in being broad with an uneven, somewhat undulate margin and acuminate apex. The disposition and shape of the leaves and the general habit of growth are also very similar in the two species. *A. rigidissima* is distinct from *A. suffrutescens* on the basis of its narrower ascending instead of reflexed siliques and narrowly instead of broadly winged seeds. The latter character is fundamental and immediately sets the two species apart. The siliques are borne in a divaricately ascending position in *A. rigidissima* similar to the silique-position in *A. divaricarpa* which it superficially resembles. However, these two species are not particularly related and differ in the form of silique, size of seeds, size of flower parts and shape and disposition of the leaves. In many ways *A. rigidissima* represents a transitional type between that group of species with broad siliques and widely winged seeds of which *A. suffrutescens* and *A. platysperma* are representative, and the more abundant group in *Arabis* with narrow siliques and narrowly winged seeds. The silique-position is also that of *A. platysperma,* but our plant does not have the very broadly winged seeds characteristic of the latter species.

18. A. LEMMONI Watson. Deep-rooted perennial; stems several to numerous from a branching caudex, slender, simple, pubescent throughout or usually glabrous above, 6–20 (–40) cm. high; basal leaves broadly spatulate-oblanceolate (much nar-

rower in var. *depauperata*), entire to few-toothed, usually obtuse, densely pubescent with minute dendritic trichomes, pannose (except in var. *paddoensis*), 1–2 cm. long; cauline leaves sessile, oblong-lanceolate to somewhat ovate, auriculate and slightly clasping, glabrous or the lower pubescent (all pubescent in var. *depauperata*), 4–10 (–15) mm. long; sepals oblong, obtuse, non-saccate, glabrous to sparsely pubescent, often purplish, 2–3 mm. long; petals pink to purple, spatulate, 4–6 mm. long; glandular tissue moderately developed, continuous beneath all stamens; pedicels glabrous or rarely pubescent, 2–5 mm. long; siliques usually horizontal, sometimes slightly ascending or somewhat pendent (divaricately ascending in var. *depauperata*), straight to slightly curved, glabrous, nerved to the middle, 2–4 (–5) cm. long, 2–3.5 mm. wide; stigma sessile or the style very short; seeds orbicular, narrowly winged, slightly more than 1 mm. broad, uniseriate.

Key to the Varieties of A. Lemmoni

Siliques divaricately ascending; basal leaves narrowly oblanceolate to lanceolate; fruiting raceme not secund. .18d. Var. *depauperata*.
Siliques horizontal or slightly descending; basal leaves spatulate; fruiting raceme usually somewhat secund.
 Basal leaves sparsely pubescent to glabrous........18b. Var. *paddoensis*.
 Basal leaves densely pubescent, usually pannose.
  Siliques 2–2.5 mm. broad, 2–4 cm. long; stems numerous, less than 2 dm. high..............................18a. Var. *typica*.
  Siliques 2.5–3.5 mm. broad, 3–5 cm. long; stems few, 2–4 dm. high..................................18c. Var. *drepanoloba*.

18a. Var. **typica.** *A. Lemmoni* Watson in Proc. Am. Acad. **22:** 467 (1887) and in Gray, Syn. Fl. N. Am. **1:** 166 (1895); Howell, Fl. Northw. Am. **1:** 44 (1897); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 360 (1918); Henry, Fl. So. Brit. Columb. 149 (1918); Jepson, Man. Fl. Pl. Calif. 430 (1925) in part and Fl. Calif. **2:** 65 (1936) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 36, fig. 10 (1936). *A. canescens* Nuttall, var. *latifolia* Watson in King, Geol. Expl. Fortieth Parallel **5:** 17 (1871). *A. latifolia* (Watson) Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906). *A. bracteolata* Greene, Leaflets **2:** 73 (1910). *A. Kennedyi* Greene, ibid. p. 71. *A. oreocallis* Greene, ibid. p. 73. *A. polyclada* Greene, ibid. p. 75. *A. semisepulta* Greene, ibid. p. 74. *A. Egglestonii* Rydberg, Fl. Rky. Mts. 361 (1918).—Montana to Colorado, California and British Columbia. Map 9. Montana: Glacier Park, Aug., 1919, *Standley 17737* (US), July, 1933, *C. L. Hitchcock 2043* (P); Black Butte, Tobacco Root Range, Aug., 1902, *Blankinship s.n.* (G); Blackfoot Glacier, Aug., 1909, *M. E. Jones s.n.* (P); Bridger Mts., June, 1897, *Rydberg & Bessey 4223* (G);

Lone Mt., Gallatin Co., Aug., 1906, *Roadhous & Chestnut 29* (UC), June, 1901, *W. W. Jones s.n.* (G, RM, UC); Crazy Mts., Park Co., July, 1902, *Blankinship s.n.* (RM). Wyoming: Fremont Peak, Aug., 1878, *C. Richardson s.n.* (G); Beartooth Butte, Park Co., July, 1939, *Rollins & Muñoz 2838* (G, R), Aug., 1937, *L. O. & R. P. Williams 3760* (R); northwestern Wyoming, Aug., 1893, *Rose 399a* (US, type of *A. bracteolata*); Mt. Washburn, July, 1932, *B. & R. Maguire 1169* (UAC); Piney Mt., July, 1922, *E. B. & L. B. Payson 2674* (G, US); Teton Pass Mts., July, 1920, *E. B. & L. B. Payson 2135* (G). Colorado: Clover Mt., above Garfield, July, 1910, *Eggleston 6013* (NY, type; US, isotype of *A. Egglestonii*). Idaho: Brazil's, Birch Creek, Lemhi Co., June, 1939, *Davis 1046* (R); Mt. Hyndman, Blaine Co., July, 1936, *Thompson 13637* (G, R, T); near Clyde, Blaine Co., July, 1916, *Macbride & Payson 3137* (G, RM, US); Parker Mt., Custer Co., July, 1916, *Macbride & Payson 3257* (G); 7 miles north of Dickey, Custer Co., June, 1938, *Hitchcock 3796* (R); Caribou Mt., Bonneville Co., July, 1923, *Payson & Armstrong 3565* (G, P). Utah: Henry's Fork Basin, Summit Co., Aug., 1936, *Maguire et al. 14688* (G, R, UAC); Gunsight Pass, Summit Co., *Maguire et al. 14564* (G, R, UAC); La Motte Peak, Uinta Mountains, July, 1926, *E. B. & L. B. Payson 5091* (M, RM); Mt. Agassiz, Duchesne Co., Aug., 1933, *Maguire et al. 4144* (UAC); Black Mt., near Salt Lake City, May, 1903, *Mrs. Joseph Clemens s.n.* (G); Cottonwood Canyon, May, 1932, *Burke 2977* (UAC). Nevada: alpine peak east of Mt. Wheeler, Snake Range, White Pine Co., July, 1938, *Rollins & Chambers 2477* (G, R); Jarbidge, July, 1912, *Nelson & Macbride 1971* (G); above Liberty Pass, Ruby Mts., about 16 miles southeast of Lamoille, Elko Co., July, 1938, *Rollins & Chambers 2554* (G, R); Duck Creek near Ely, Aug., 1913, *A. E. Hitchcock 1411* (US); Clover Mts., Sept., 1868, *S. Watson 71* (G, type of *A. canescens*, var. *latifolia*); Toiyabe Dome, Toiyabe Mts., Aug., 1939, *Hitchcock & Martin 5623* (R); Galena Creek, Washoe Co., Aug., 1906, *Kennedy 1248* (US, type; NY, isotype of *A. Kennedyi* Greene); Mt. Rose, Washoe Co., Aug., 1938, *J. T. Howell 14215* (G, R). California: Lassen Peak, Sept., 1872, *J. G. Lemmon 23* (G, type), Aug., 1882, *Mrs. R. M. Austin s.n.* (G, UC); White Mt., Conness Range, Tuolumne Co., July, 1936, *Mason 11326* (G, UC); Kaiser Peak, Fresno Co., July, 1914, *Smiley 644* (G); Mt. Warren Pass, Mono Co., Aug., 1894, *Congdon 613* (G, UC); Virginia Lakes Basin, Mono Co., July, 1934, *Peirson 11331* (Peirs); Rock Creek Lake Basin, Inyo Co., July, 1934, *Peirson 11296* (Peirs); Farewell Gap, Tulare Co., 1897, *C. A. Purpus 5229* (US, type; G, UC, isotypes of *A. polyclada*), Aug., 1891, *Coville & Funston 1747* (G). Oregon: Wallowa Mts., Baker Co., July, 1936, *Thompson 13399* (R, T), July, 1899,

Cusick 2264 (G, UC, US, WSC); near Wallowa Lake, Wallowa Co., July, 1936, *L. S. Rose 36610* (R); Mt. Thielson, Klamath Co., Aug., 1897, *Coville & Applegate 454* (US, TYPE; RM, isotype of *A. semisepulta*); Mt. Scott, Crater Lake, July, 1935, *Thompson 12280* (T, UW), Sept., 1902, *Coville 1489* (US). Washington: Mt. Stuart, Chelan Co., July, 1931, *Thompson 7700* in part (G, UC); Three Brothers Peak, Chelan Co., June, 1934, *Thompson 10582* (T); Mt. Adams, Aug., 1906, *Suksdorf 1920* (G, R, UC, US, WSC), Aug., 1885, *Suksdorf 510* (G); Mt. Angeles, Clallam Co., June, 1932, *Thompson 8393* (G), July, 1933, *Thompson 9465* (NY). British Columbia: Beaverfoot Mts., Selkirk and Rky. Mts., July, 1904, *C. H. Shaw 315* (US, TYPE; G, isotype of *A. oreocallis*); Bow River Pass, Sept., 1879, *Macoun 74* (G); Silver City, Aug., 1885, *J. Macoun s.n.* (G); summit of Rky. Mts., Aug., 1890, *J. Macoun s.n.* (G); Bluster Mt., Marble Mts., July, 1938, *J. & E. Thompson 457* (G); Chipuin Mt., Marble Mts., July, 1938, *J. & E. Thompson 627* (G).

18b. Var. **paddoensis,** var. nov. Herba glabra vel sparse pubescens; caulibus 1–2.5 dm. altis; foliis radicalibus sparse pubescentibus vel glabris spathulatis vel oblanceolatis. Map 10. Washington: Mt. Stuart region, Kittitas Co., 1931, *Thompson 7753½* (G); high alpine ridges at head of Beverly Creek, Kittitas Co., July, 1933, *Thompson 9500* (G, T); east of Mt. Adams, Aug., 1892, *Henderson 2391* (G, UW); rocks, Mt. Adams (Paddo), Aug., 1885, *Suksdorf 509* (G, TYPE), Sept., 1905, *Suksdorf 5296* (G).

18c. Var. **drepanoloba** (Greene) comb. nov. Stems few, 1.5–4 dm. high; pubescence of basal leaves coarser and less dense than in var. *typica;* siliques 3–5 cm. long, 2.5–3.5 mm. wide.—*A. drepanoloba* Greene in Pitt. **3:** 306 (1898); Rydberg, Fl. Rky. Mts. 360 (1918).—Alberta to Wyoming. Map 11. Alberta: Crow Nest Pass, Aug., 1897, *Macoun 18114* (G); Devil's Head Lake, Banff, Aug., 1891, *Macoun 1719a* (ND, TYPE; US, isotype; photo of type in Gray Herb.); Bertha Lake, vicinity of Waterton Lakes, July, 1938, *Hunnewell 15825* (G). Montana: Glacier Nat. Park, July, 1933, *C. L. Hitchcock 2043* (G, P), July, 1919, *Standley 15796* (US). Wyoming: Gros Ventre Mts., Sublette Co., Aug., 1922, *E. B. & L. B. Payson 3039* (G, M, P, RM, US); near Alpine, Lincoln Co., July, 1923, *Payson & Armstrong 3463* (G, M, RM); northeast of Smoot, Lincoln Co., July, 1923, *Payson & Armstrong 3637* (G, M, RM).

18d. Var. depauperata (Nelson & Kennedy) Rollins. Basal leaves narrowly oblanceolate, very finely pubescent; cauline leaves densely pubescent; pedicels and siliques divaricately ascending.—Madroño **3:** 360 (1936). *A. depauperata* Nelson & Kennedy in Proc. Biol. Soc. Wash. **19:** 36 (1906).—Nevada

and California. MAP 11. NEVADA: Bunker Hill, Toiyabe Forest, July, 1913, *A. E. Hitchcock 855 & 866* (US); Toiyabe Dome, Toiyabe Mts., Nye Co., July, 1938, *Rollins & Chambers 2522* (G, R); Mt. Rose, Washoe Co., Aug., 1905, *Kennedy 1167* (RM, TYPE; UC, isotype), July, 1909, *Heller 9868* (NY, US), July, 1939, *Hitchcock & Martin 5497* (R). CALIFORNIA: Tinkers Knob, Placer Co., July, 1897, *S. F. Sonne s.n.* (P, UC); Mt. Tallac, Eldorado Co., July, 1903, *Hall & Chandler 4624* (UC); Rubicon Peak, Eldorado Co., Aug., 1913, *Smiley 405* (G); near Crest View, 19 miles south of Mono Lake, Aug., 1938, *Constance 2462* (R); Olancha Mt., Tulare Co., June, 1904, *Hall & Babcock 5229* (G).

Watson first listed plants of *A. Lemmoni* both as *A. canescens* and as *A. canescens*, var. *latifolia*, but an accumulation of specimens from the high mountains of several western states led him to separate them later as a distinct species. Of the several specimens cited with the original description, one from Lassen Peak, California, by J. G. Lemmon must be regarded as the type. *A. Lemmoni* is found on the highest peaks in many of the main ranges of western America. Its range is necessarily disrupted due to the lack of tolerable habitats between the high peaks, many of which have undoubtedly been isolated for a considerable period. This probably contributes to the fact that *A. Lemmoni* exhibits a number of minor variations in its morphology when plants from the entire geographic range are considered. As shown by the list of synonyms, a number of independent specific names have been proposed for the various phases of this species. Most of these were proposed without due regard for the usual variations found in even a single colony of *A. Lemmoni.*

Three varieties are distinctive and have been set off to indicate the directions in which particular specialization is apparently taking place in the species. These varieties share with var. *typica* only a fragment of the total range of the species and differ from each other and the typical variety in several ways. Var. *depauperata* has divaricately ascending siliques which are rarely secund instead of the horizontally spreading to slightly reflexed secund siliques of the other varieties. It is more pubescent above, has narrower, longer siliques and narrower basal leaves than var. *typica*. Var. *drepanoloba* is larger in stature with broader siliques and a more scanty, slightly coarser pubes-

cence than is found in the typical variety. Var. *paddoensis* is restricted to the Cascade Range in central and southern Washington and differs from the typical variety in being wholly glabrous or only scantily pubescent.

19. A. oxylobula Greene. Caespitose perennial; caudex simple or branching, densely covered with old leaf-bases; stems slender, numerous, simple, glabrous, 8–12 cm. high; basal leaves linear to narrowly oblanceolate, entire, acute, glabrous or the petioles sparingly hirsute with simple trichomes, 2–3 cm. long, 3–5 mm. wide; cauline leaves few, oblong, remote, entire or minutely denticulate, glabrous, teeth and apex often cuspidate, sessile, not auriculate, 8–15 mm. long; inflorescence few-flowered, loose; sepals glabrous, oblong, 2–3 mm. long, about 1 mm. wide; petals lingulate to spatulate, pink, about 5 mm. long, 1.5–2 mm. wide; glands poorly developed; pedicels filiform, glabrous, arched or horizontal, 3–6 mm. long; siliques glabrous, widely pendulous to spreading almost at right angles, nerved to the middle or above, 1.5–2.5 cm. long, 1.5–2 mm. wide; seeds orbicular, winged all around, about 1 mm. wide, uniseriate.—Pittonia **4:** 195 (1900); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909) in part; Rydberg, Fl. Rky. Mts. 361 (1918).—Colorado: Glenwood Springs, Garfield Co., June, 18, 1899, *G. E. Osterhout s.n.* (ND, type; photo in Gray Herb.), June 6, 1902, *Osterhout 2575* (NY, RM).

Unfortunately too little material is available of this species. It is related to *A. demissa*, but differs in having broader cauline leaves, basal leaves with thinner texture, and more numerous filiform stems. Also the siliques of *A. oxylobula* are shorter, more acute and more widely spreading than those of *A. demissa*. The present disposition of *A. oxylobula* is frankly provisional. A larger suite of specimens may show an intergradation with *A. demissa* in which case it would be better treated as a variety.

20. A. demissa Greene. Perennial, caespitose; stems several to numerous from a simple or branching caudex, simple or rarely branched above, slender, hirsute below or glabrous throughout, 1–3 dm. high; basal leaves linear to oblanceolate, acute or the outer obtuse, entire, hirsute with large simple or forked trichomes or rarely nearly glabrous, margins usually ciliate, 1.5–3.5 cm. long, 2–5 mm. wide; cauline leaves remote, sessile, not auriculate except in var. *languida*, 5–10 mm. long, 1.5–4 mm. wide, lower usually sparsely hirsute, upper glabrous; sepals oblong, sparsely pubescent, non-saccate, 2–3.5 mm. long, about 1.5 mm. broad; petals white to pink, spatulate, 4.5–6.5 mm.

long, 1.5–2 mm. broad; nectar-glands developed around single stamens, merely subtending paired stamens; pedicels glabrous, slender, arched downward, 3–7 mm. long; siliques pendulous, nerved about to the middle, 2–4 cm. long, 1.5–2 mm. wide, valves often constricted between seeds; stigma sessile; seeds orbicular to slightly oblong, plump, narrowly winged or wingless, about 1 mm. broad, uniseriate.

Key to the Varieties of A. demissa

a. Basal leaves linear to narrowly oblanceolate; cauline leaves without auricles.......................................b.
  b. Trichomes on leaves and stems simple; basal portion of stems sparsely hirsute or the stems completely glabrous; valves of siliques not constricted between seeds; seeds wingless; southern Wyoming and northeastern Utah.......................................20b. Var. *russeola.*
  b. Trichomes on leaf-blades forked and smaller than those of the margins; basal portion of stems hirsute with forked trichomes; valves of siliques constricted between seeds; seeds narrowly winged to wingless; Colorado.......................................20a. Var. *typica.*
a. Outer basal leaves oblanceolate; cauline leaves auriculate; southern Wyoming and northeastern Utah......20c. Var. *languida.*

20a. Var. **typica.** *A. demissa* Greene, Pl. Baker. **3:** 8 (1901). *A. rugocarpa* Osterhout in Bull. Torr. Bot. Club **31:** 357 (1904); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 361 (1918). *A. aprica* Osterhout ex Nelson in Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909).—Map 8. Colorado: Sulphur Springs, Grand Co., June, 1907, *Osterhout 3540* (RM, type; NY, isotype of *A. aprica*); Malta Station, near Leadville, Lake Co., June, 1903, *Osterhout 2800* (RM, type; NY, isotype of *A. rugocarpa*); June, 1900, *Osterhout 2096* (NY); Phipps Ranch, Mineral Co., May, 1911, *J. Murdoch Jr. 4511* (M, NY, US); near Sargents, Saguache Co., May, 1938, *Rollins 2086* (G, R); June, 1928, *Osterhout 6920* (M); 4 miles east of Gunnison, May, 1938, *Rollins 2099* (G, R); 1 mile east of Sapinero, May, 1938, *Rollins 2113* (G, R); 5 miles south of Iola, Gunnison Co., Sept., 1937, *Rollins 2002* (G, R); in a stony river bed, Cimarron, Gunnison Co., 1901, *C. F. Baker 16* (ND, type; photo in Gray Herb.).

20b. Var. **russeola,** var. nov. Herba caespitosa; caulibus glabris vel inferne pilosis, 1–2.5 dm. altis; foliis radicalibus hirsutis; caulinis remotis non auriculatis; petalis albis; seminibus orbicularibus exalatis uniseriatis.—Wyoming and Utah. Wyoming: Laramie Hills, Albany Co., June, 1899, *E. Nelson 212* (G, NY). Utah: vicinity of Flaming Gorge, Daggett Co., June, 1938, *Rollins 2272* (G, R), May, 1932, *L. Williams 459* (G, NY, RM); 18 miles north of Vernal, Uintah Co., June, 1937, *Rollins 1757* (G, type; R, isotype).

20c. Var. **languida,** var. nov. Herba multicaulis caespitosa; caulibus simplicibus vel superne ramosis 1–3 dm. altis; foliis radicalibus hirsutis; caulinis auriculatis; pedicellis 4–7 mm. longis; seminibus orbicularibus exalatis vel anguste alatis uniseriatis 1 mm. latis.—Wyoming and Utah. Map 8. Wyoming: Albany Co., Laramie Hills, May, 1896, *A. Nelson 1885* (NY, P, US); near City Springs, east of Laramie, June 14, 1936, *Rollins 1178* (G, type; R, isotype), June, 1935, *L. Williams 2183* (G, M), June, 1937, *Rollins 1610* (G, R); 2 miles southeast of Green River, Sweetwater Co., June, 1938, *Rollins 2250* (G, R). Utah: 15 miles southeast of Manila, near Flaming Gorge, Daggett Co., June, 1938, *Rollins 2279* (G, R).

Typical *A. demissa* is very abundant on exposed stony knolls in the Gunnison Basin of western Colorado. The plants are often associated with dwarfed sagebrush and in some small areas devoid of shrubby types it becomes the dominant species. The type specimen of *A. demissa* collected in a "stony river bed", which is an unnatural habitat for the species, is nearly glabrous, only the petioles of the basal leaves being hirsute. Usually, the young basal leaves are conspicuously hirsute with large simple or forked trichomes, but much of the indument is shed as the leaves mature. Often plants are found with the outer basal leaves completely glabrous, while the inner are densely hirsute.

A. demissa is nearest related to *A. Fendleri*, var. *spatifolia*, from which it differs in being caespitose with numerous stems instead of being one- to few-stemmed, in having larger seeds which are disposed in a single row rather than a double row, and small, remote cauline leaves in place of relatively large, imbricated ones. *A. demissa*, var. *typica* has the valves markedly constricted between the seeds, but this character is not found in vars. *russeola* and *languida* in which the valves are plane. Var. *languida* has auriculate cauline leaves, whereas in vars. *typica* and *russeola* the cauline leaves lack auricles.

21. A. pendulina Greene. Perennial; stems several to numerous from a simple caudex, hirsute with simple trichomes below to glabrous throughout, simple or rarely branched above, usually slender, 1–4 dm. high; basal leaves spatulate to linear-oblanceolate, entire, hirsute with simple trichomes to glabrous, 1–4 cm. long, 3–10 mm. wide, petioles slender; cauline sessile, usually non-auriculate, lanceolate to slightly broader, acute, glabrous

or the lower hirsute, 5–10 mm. long, 2–6 mm. wide; inflorescence few-flowered, lax; pedicels slender, arched downward, glabrous, 5–10 mm. long; sepals oblong, glabrous or hirsute with a few large trichomes, usually purplish, non-saccate, 3-4 mm. long; petals pink to purplish, spatulate, 5–6 mm. long, about 2 mm. broad; glandular tissue continuous under both single and paired stamens, poorly developed; siliques glabrous, pendulous, straight to slightly curved, obtuse, nerved below, 2–4 cm. long, 2–3 mm. broad; stigma sessile; seeds biseriate, slightly oblong, wingless, about 1 mm. broad.—Leaflets **2:** 81 (1910); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 245 (1925). *A. setulosa* Greene, Leaflets **2:** 81 (1910). *A. Diehlii* M. E. Jones, Contrib. West. Bot. **14:** 38 (1912). *A. nevadensis* Tidestrom in Proc. Biol. Soc. Wash. **36:** 182 (1923).—Utah and Nevada. MAP 11. UTAH: Marysvale, June, 1894, *M. E. Jones 5330* (US, TYPE; NY, P, UC, isotypes of *A. setulosa*); Joe's Valley, Emery Co., May, 1932, *Pickford & Pechanec 139* (FS); Cedar Ridge, Sevier Co., May, 1923, *Miller 246* (FS). NEVADA: near Lehman Creek, east of Mt. Wheeler, Snake Range, White Pine Co., July, 1938, *Rollins & Chambers 2469* (G, R), June, 1927, *Gray 155* (FS); Charleston Mts., Clark Co., May–Oct., 1898, *C. A. Purpus 6104* (US, TYPE; UC, isotype); Clark Canyon, Charleston Mts., June, 1936, *Clokey 7125* (G, R); head of Lee Canyon, Charleston Mts., Aug., 1913, *Heller 11077* (US, TYPE; G, NY, UC, isotypes of *A. nevadensis*); Deer Creek, Charleston Mts., June, 1939, *Alexander 743c* (G, UC); Hidden Forest, Sheep Mts., Clark Co., May, 1940, *Alexander & Kellogg 1520* (R).

Arabis pendulina is closely related to *A. Fendleri*, but differs in having smaller, usually entire basal leaves, numerous slender stems, small, remote, usually non-clasping cauline leaves and shorter siliques. The plants are more tufted and never attain the robustness found in *A. Fendleri*. There is also a difference in the type of pubescence exhibited on the basal leaves of the two species. In *A. pendulina*, the pubescence is predominantly simple on the leaf-surfaces and margins, whereas in *A. Fendleri* the pubescence is commonly forked, especially on the leaf-surfaces.

The glabrous phase of *A. pendulina* was named *A. nevadensis* by Tidestrom, but this, as in other species of *Arabis*, is a feature often found in plants growing at high altitudes. All stages between glabrous and hirsute types have been repeatedly observed. *A. setulosa* Greene and *A. Diehlii* Jones were based on plants collected in the mountains near Marysvale, Utah.

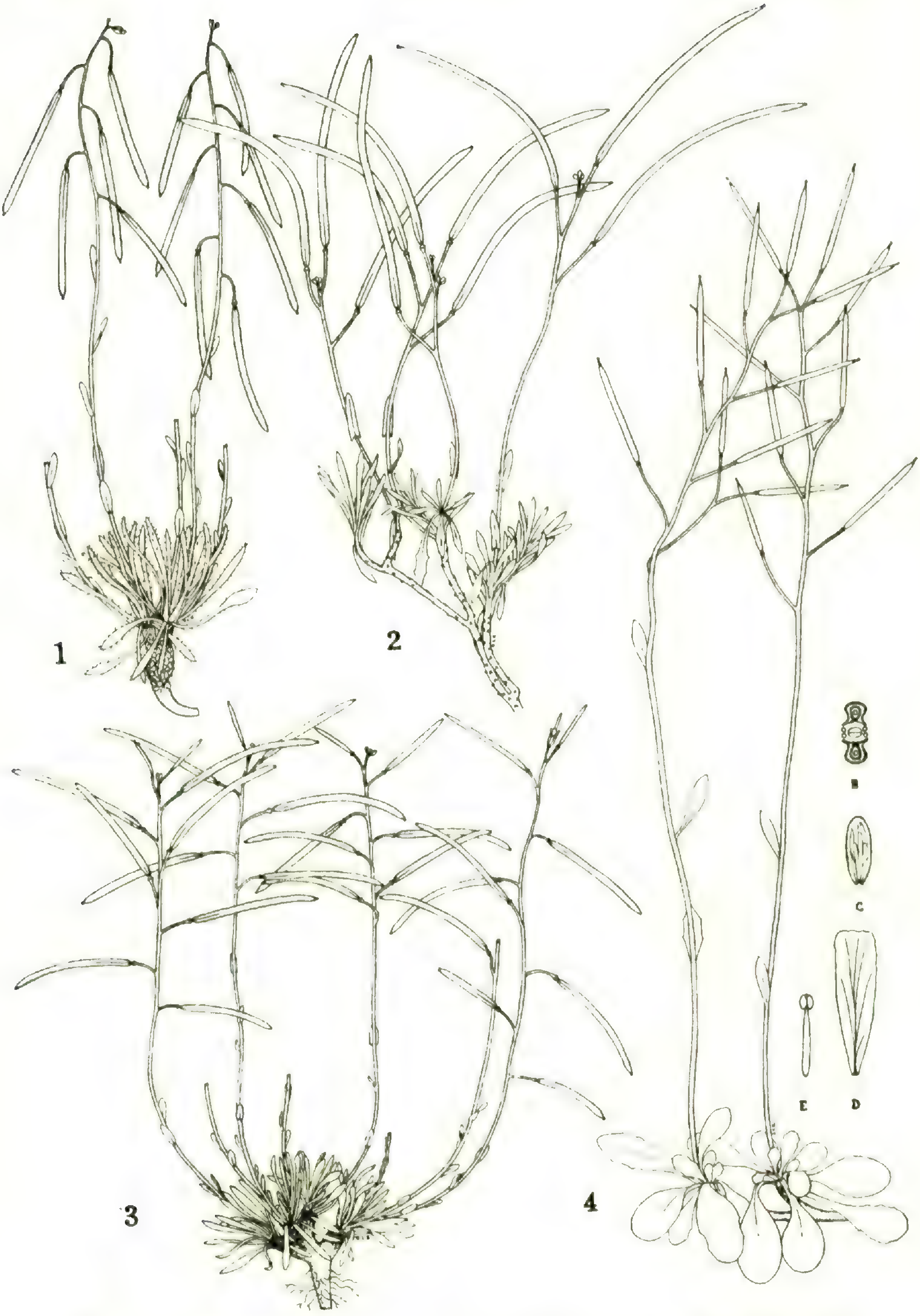


Fig. 1. A. demissa drawn from *Rollins 2113;* Fig. 2. A. Koehleri drawn from *Cusick 2905;* Fig. 3. A. Gunnisoniana drawn from *Rollins 2090;* Fig. 4. A. crucisetosa drawn from *Rollins, Contance & Dillon 1107*.

B. Diagram of the glandular tissue on the receptacle; C. Sepal about two times natural size; D. Petal about two times natural size; E. Stamen about two times natural size. All figures about one-half natural size except figures 4B, 4C, 4D, and 4E.

It is not certain that the same species was described in each case because I have been unable to locate the type of *A. Diehlii* in Jones's herbarium at Pomona College, but the two descriptions are very similar. Certainly *A. setulosa* does not fall outside the natural specific variation found in *A. pendulina.*

22. A. RECTISSIMA Greene. Biennial; stems one to several from a simple or rarely branched caudex, often purplish, simple to branched above, sometimes rather stout, glabrous to sparsely hirsute below with coarse, simple trichomes, 2–8 dm. high; basal leaves numerous, spatulate to oblanceolate, short-petioled, entire, hirsute with coarse simple and forked trichomes, 1–3 cm. long, 4–10 mm. wide, blade-surfaces sometimes glabrous, margins always ciliate; cauline leaves crowded below, remote above, oblong to nearly lanceolate, obtuse, auriculate or the auricles nearly wanting, sessile, ciliate, sparsely hirsute or the upper glabrous, 1–2 cm. long, 3–8 mm. wide; sepals oblong, obtuse, sparsely hirsute near apex, 2–3 mm. long; petals spatulate to narrowly lingulate, white or rarely pinkish, 4–6 mm. long, 1–2 mm. wide; glandular tissue well developed in a continuous ring beneath all stamens; fruiting raceme 1–4 dm. long; pedicels glabrous, strictly reflexed, 4–12 mm. long; siliques numerous, crowded, straight, strictly reflexed, appressed to the rachis, glabrous, 1-nerved below, acute at apex, 5–8 cm. long, 1.5–2.5 mm. wide; stigma sessile or nearly so; seeds orbicular, winged all around, about 1.5 mm. broad, uniseriate.—Pittonia **4:** 191 (1900); Jepson, Fl. Calif. **2:** 68 (1936); Rollins in Madroño **3:** 362 (1936) and in Res. Stud. State Coll. Wash. **4:** 30 (1936); Applegate in Am. Midl. Natur. **22:** 269 (1939). *A. setigera* Greene, Leaflets **2:** 80 (1910). *A. Holboellii,* var. *Fendleri* sensu Jepson, Man. Fl. Pl. Calif. 429 (1925). *A. Wyndii* Henderson in RHODORA **32:** 25 (1930).—Western Nevada, California and southern Oregon. MAP 12. NEVADA: Creek at Incline, Lake Tahoe, Washoe Co., Aug., 1938, *Archer 6695* (NA). CALIFORNIA: near Black Butte, north of Sisson, Siskiyou Co., June, 1916, *Heller 12421* (Cl, G, M, Ph, US, WSC); Mt. Shasta, July, 1912, *Eastwood 1231* (G); Diamond Mt., Lassen Co., June, 1897, *M. E. Jones s.n.* in part (P); Prattville, Plumas Co., July, 1907, *Heller & Kennedy 8809* (G, P, UC, US); Jonesville, Butte Co., July, 1929, *Copeland 367* (G, NY, US); Downieville, Sierra Co., May, 1854, *J. M. Bigelow s.n.* (G); Rubicon Park, Eldorado Co., July, 1901, *Setchell & Dobie s.n.* (UC); Cascade Creek, western Yosemite Nat. Park, Tuolumne Co., July, 1934, *Hodgdon & Rossbach 5* (G); Sunrise Trail, Yosemite Nat. Park, Mariposa Co., July, 1936, *H. K. Sharsmith 3808* (R); 1 mile northwest of Ellis Meadow, Madera Co., July, 1938, *Constance 2393* (R); Dinkey

Creek, Fresno Co., June, 1900, *Hall & Chandler 346* (UC); Fresno Co., 1890, *Mrs. Peckinpah s.n.* (ND, TYPE; NY, isotype); Olancha Mt., Tulare Co., June, 1904, *Hall & Babcock 5290* (UC); north side of Bear Lake, San Bernardino Mts., June, 1922, *Munz 5729* (P); City Creek Grade, San Bernardino Mts., June, 1926, *M. E. Jones s.n.* (P). OREGON: Corral Springs, Klamath Co., Aug. 2, 1894, *Leiberg 610* (US, TYPE; G, O, UC, isotypes of *A. setigera*); Cherry Cr., Klamath Co., July, 1899, *Leiberg 4305* (O, US); 5 miles north of Fort Klamath, July, 1920, *Peck 9564* (G, M, W, WSC); Crater Lake, July, 1928, *Wynd 2322* (O, TYPE of *A. Wyndii*).

The pubescence of *A. rectissima* is similar to that of *A. Fendleri* and *A. pendulina*. Instead of the widely spreading pedicels and curved pendulous siliques found in those species, *A. rectissima* has strictly reflexed pedicels and straight siliques. A unique feature of this species is the long fruiting raceme which often occupies over half the entire length of the stem. *A. rectissima* has often been confused with varieties of *A. Holboellii*, but plants of these species are not as closely related as historical treatments would seem to indicate. The large acicular trichomes fringing the basal leaf-blades in *A. rectissima* are a quick mark of identity.

Beginning in the southern Cascade Mountains of Oregon, *A. rectissima* is found at middle elevations almost continuously along the Sierra Nevada mountain-axis to Tulare County, then, like many other plants of similar distribution, it jumps to the San Bernardino Mountains where its geographical area is relatively limited.

23. A. FENDLERI (Watson) Greene. Perennial; stems one to several from a simple caudex, simple or branched above, hirsute below with simple, spreading trichomes, glabrous above, 2.5–6 dm. high; basal leaves oblanceolate to linear-oblanceolate, entire to coarsely dentate, densely pubescent with coarse, simple or forked trichomes or the surfaces nearly glabrous, margins ciliate, 2–6 cm. long, (2–) 3–15 mm. broad; cauline leaves sessile, oblong to lanceolate, auriculate, lower pubescent and usually imbricated, upper glabrate, entire or rarely dentate, 1–4 cm. long, 2–8 mm. broad; pedicels slender, ascending at anthesis, arched downward in fruit, glabrous, 1–2 cm. long; sepals glabrous or usually with a few trichomes, oblong, 3–5 mm. long, 1.5–2 mm. broad; petals spatulate, white to pink, 5–8 mm. long, 2–3 mm. broad; nectar-glands subtending single stamens, poorly developed be-

low paired stamens; siliques glabrous, pendulous, nerved to the middle or slightly above, obtuse, 3–6 cm. long, 1.5–2.5 mm. wide; stigma sessile; seeds orbicular to slightly oblong, narrowly winged or rarely almost wingless, 1–1.5 mm. broad, biseriate.

Basal leaves dentate, oblanceolate, obtuse; petals pink....23a. Var. *typica*.
Basal leaves entire, linear-oblanceolate, acute; petals white
23b. Var. *spatifolia*.

23a. Var. **typica.** *A. Fendleri* (Watson) Greene, Pitt. **3:** 156 (1897); Rydberg, Fl. Colo. 165 (1906); Coulter & Nelson, New Man. Rky. Mts. 229 (1909); Wooton & Standley in Contrib. U. S. Nat. Herb. **19:** 280 (1915) in part; Rydberg, Fl. Rky. Mts. 362 (1918) in part. *A. Holboellii* Hornem., var. *Fendleri* Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895). *A. porphyrea* Wooton & Standley in Contrib. U. S. Nat. Herb. **16:** 123 (1913), ibid. **19:** 280 (1915).—Colorado to Texas, northern Mexico and Nevada. MAP 12.[1] COLORADO: Wolhurst, Douglas Co., May, 1920, *Clokey 3785* (Cl, G, P); La Veta Pass, Costilla Co., June, 1936, *Rollins 1288* (R); 4 miles east of Gunnison, Gunnison Co., May, 1938, *Rollins 2098* (G, R). NEW MEXICO: without locality, 1847, *A. Fendler 27* (G, TYPE; NY, isotype; a sheet of this number at the Missouri Botanical Garden is a mixture of *A. Fendleri* and *A. perennans*); near Santa Fe, May, 1897, *A. A. & E. Heller 3562* (M; other specimens of this collection are *A. perennans*); South Percha Creek, Sierra Co., May, 1905, *Metcalfe 1591* (M); Silver City, April, 1919, *Eastwood 8219* (Cl, G); Sandia Mts., near Albuquerque, June, 1926, *E. J. Palmer 31202* (M), April, 1911, *Ellis 9* (M, NY); Tierra Amarilla, Arriba Co., April-May, 1911, *Eggleston 6446* (G, M, US); at the Cueva, Organ Mts., Dona Ana Co., April, 1907, *Wooton & Standley s.n.* (US, TYPE of *A. porphyrea*). TEXAS: Hueco Mts., El Paso Co., March, 1932, *Whitehouse 8307* (F); Sierra Blanca, April, 1930, *M. E. Jones 25824* (M); Alpine, Brewster Co., April, 1919, *Hanson 640* (M, NY). UTAH: Silver Reef, May, 1894, *M. E. Jones 5176f* in part (P); Pine Valley, Washington Co., June, 1933, *Eastwood & Howell 1270* (G). NEVADA: south end of Bristol Range, 10 miles northwest of Pioche, Lincoln Co., April, 1939, *Train 2664* (NA, R); Charleston Park, Clark Co., June, 1937, *Clokey 7538* (Cl, G, R), May, 1936, *Clokey 7121* (Cl, R); Griffith's Lodge, Charleston Mts., June, 1936, *Clokey 7119* (Cl, R). ARIZONA: Grand Canyon, June, 1916, *Eastwood 5778* (G); Kaibab, June, 1929, *M. E. Jones s.n.* (P); North Rim, Grand Canyon, June, 1933, *Eastwood & Howell 961* (G); near Flagstaff, May, 1898, *MacDougal 6* (G); 6 miles east of Flagstaff, Coconino Co., July,

[1] The symbols for vars. *typica* and *spatifolia* were inadvertently reversed in the legend of this map. The triangles indicate the range of var. *typica;* the solid circles, the range of var. *spatifolia*.

1938, *Rollins & Chambers 2811* (G). Mexico: (Lake Santa Maria) Chihuahua, 1852, *C. Wright 1313* (G).

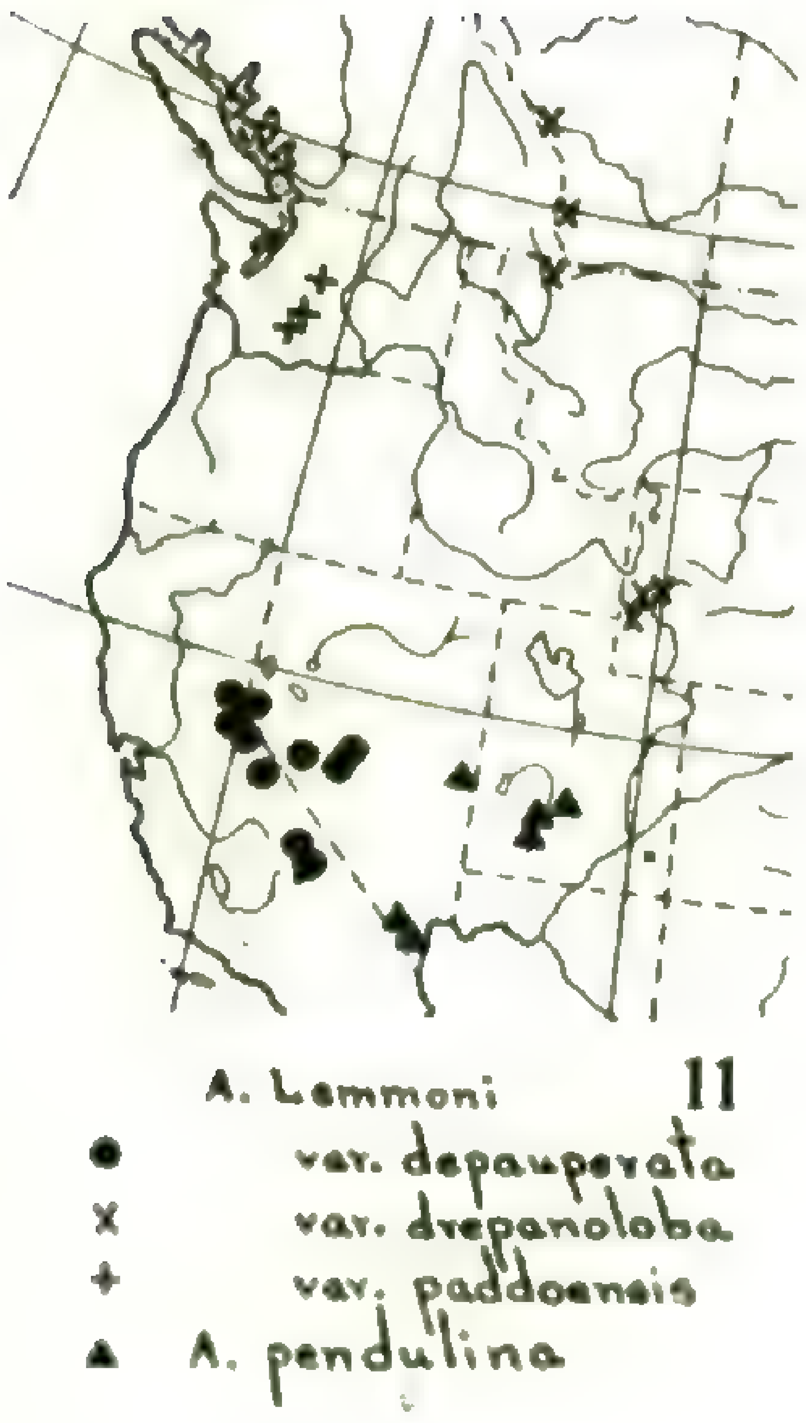
23b. Var. **spatifolia** (Rydberg), comb. nov. Stems one or few, usually branched above, 2–5 dm. high; basal leaves linear-oblanceolate, acute, 1.5–2.5 cm. long, 2–4 mm. wide; petals white, 5–6 mm. long; siliques about 2 mm. wide.—*A. spatifolia* Rydberg, Fl. Rky. Mts. 361 (1918). *A. Fendleri* sensu Rydberg, Fl. Pr. Pl. Cent. N. Am. 382 (1932) in part.—Southern Wyoming to northern New Mexico and eastern Utah. Map 12. Wyoming: Ragged Top, 25 miles north of Laramie, July, 1938, *Beetle 5591* (G, R); Dale Creek, Albany Co., June 30, 1896, *E. L. Greene s.n.* (ND); 3 miles south of Lonetree, Uinta Co., June, 1938, *Rollins 2303* (G, R). Colorado: Estes Park, Larimer Co., July, 1903, *Osterhout 2808* (NY, type; RM, isotype), June, 1916, *E. L. Johnston 90B* (G, NY, US); 4 miles west of Estes Park, Rocky Mountain National Park, June, 1938, *Rollins & Chambers 2399* (G, R); near Central City, Gilpin Co., July, 1937, *Beetle 2047* (R); Brookvale, Clear Creek Co., July, 1937, *Beetle 2065* (R); near Cripple Creek, Teller Co., Aug., 1937, *Beetle 2245* (R); Pikes Peak, June, 1935, *Ownbey 711* (R); east of Leadville, Lake Co., July, 1936, *Rollins 1349a* (R); Royal Gorge Bridge, Fremont Co., May, 1938, *Rollins 2069* (G, R); 4 miles south of Salida, Chaffee Co., May, 1938, *Rollins 2077* (G, R); Devils Hole, Huerfano Co., June, 1936, *Rollins 1254* (G, R). New Mexico: Ute Park, Colfax Co., Aug., 1916, *Standley 13619* (NY); Tres Piedras, Taos Co., June, 1930, *Talbot 1318* (NA). Utah: near Sheep Creek, 12 miles southwest of Manila, Daggett Co., June, 1938, *Rollins 2266* (G, R).

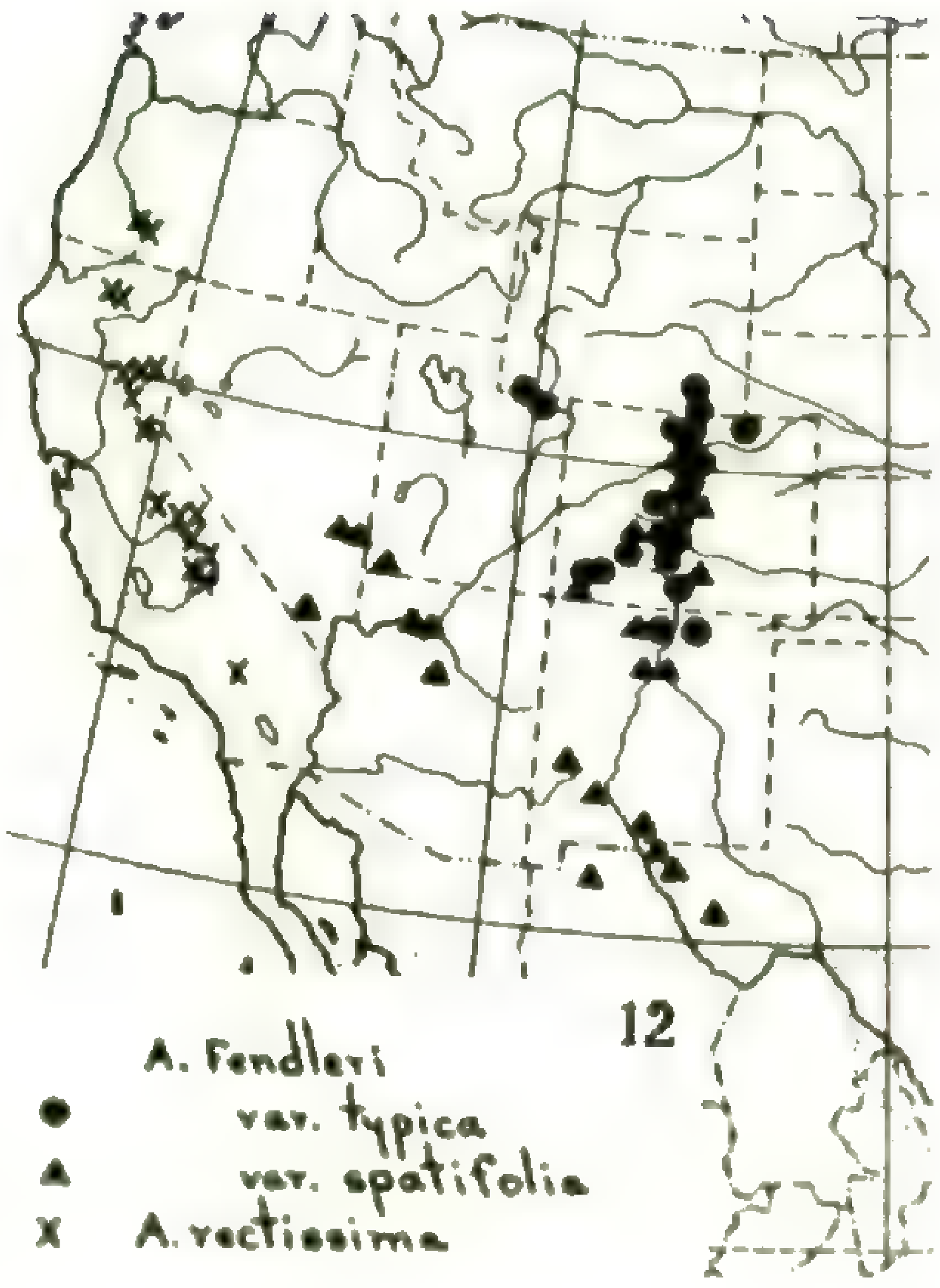
Arabis Fendleri has a very distinctive setaceous, simple or forked pubescence which makes it readily separable from the related *A. perennans*, with which it has often been confused. The latter has smaller trichomes of a dendritic type evenly covering the blade-surfaces of the basal leaves. The leaf-margins are usually ciliate in *A. Fendleri*, but this is never the case with *A. perennans*. The nearest relative of *A. Fendleri* is *A. pendulina*. This relationship has been discussed under the latter species.

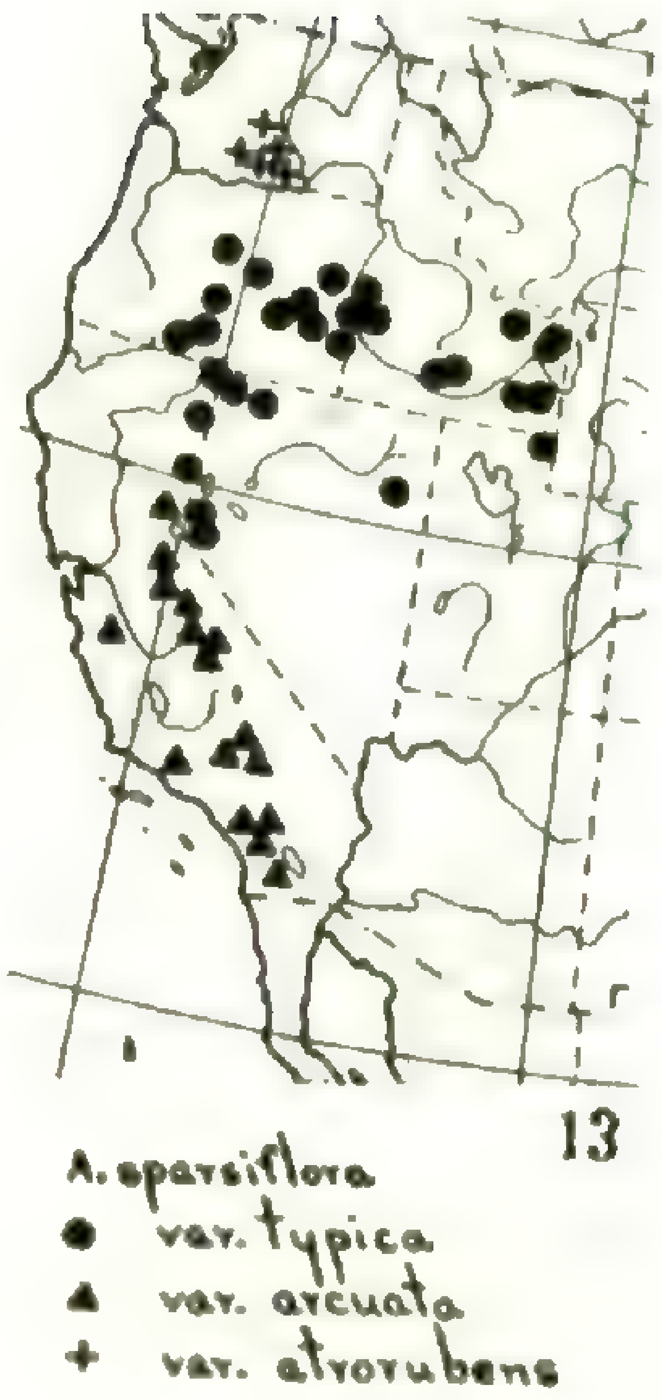
Typical *A. Fendleri* is quite variable compared to var. *spatifolia*, which shows unusual uniformity throughout its range. Perhaps some of the variability found in var. *typica* is to be associated with polyploidy which is apparently more marked here than in var. *spatifolia*. A hexaploid form of var. *typica* growing in Costilla County, Colorado, is exceedingly robust, but is not otherwise distinctive. Contrariwise, a tetraploid plant of

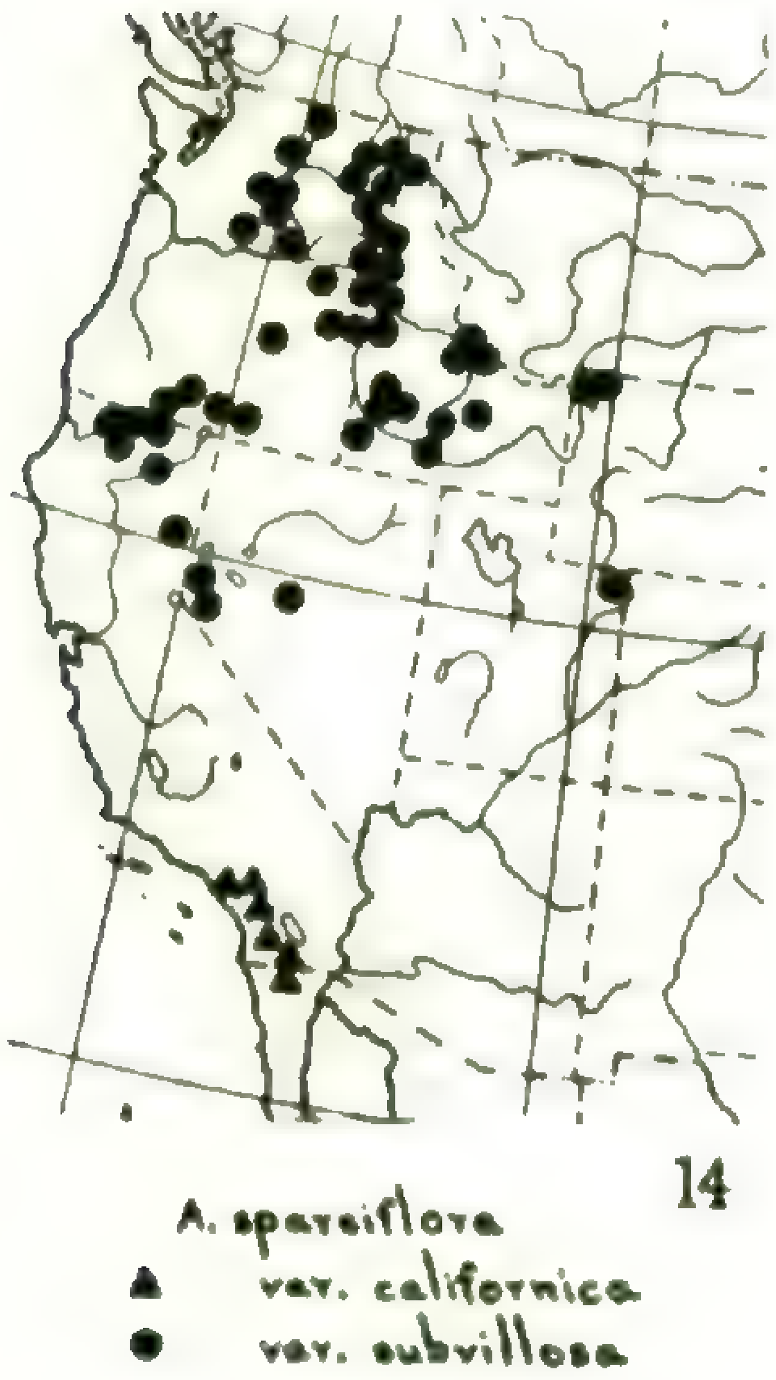
var. *spatifolia* from Gunnison County, Colorado, did not show a similar robustness. Rather, it seemed to be the same as diploid plants of the variety collected elsewhere in Colorado.

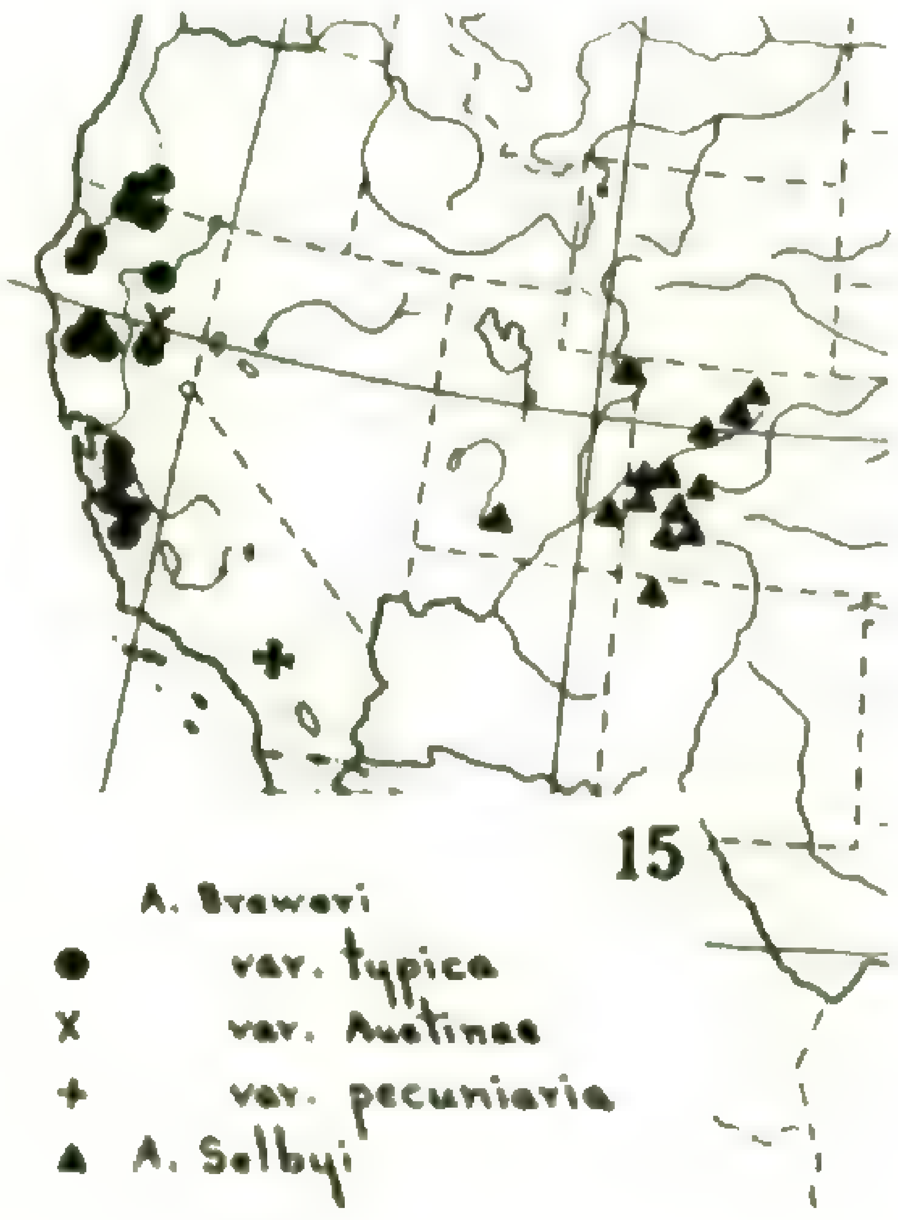
24. A. PERENNANS Watson. Perennial; stems several to numerous from a simple or branching ligneous caudex, simple or branched above, pubescent below with coarse, dendritic, usually spreading trichomes, glabrate above, 1.5–6 dm. high; caudex often elongated; basal leaves numerous, oblanceolate to broader, petiolate, dentate or rarely entire, densely pubescent with fairly coarse dendritic trichomes, 2–6 cm. long, 4–20 mm. wide; cauline leaves lanceolate, auricled and somewhat sagittate, entire or rarely sparsely dentate, 1–3 cm. long, 2–8 mm. wide, lower pubescent, upper glabrous; sepals oblong, non-saccate, pubescent, 3.5–4.5 mm. long, 1–1.5 mm. wide; petals spatulate with a narrowed claw, purple to pinkish, 6–9 mm. long, 1.5–2.5 mm. wide; pedicels very slender, spreading and arched downward, glabrous, 1–2 cm. long; siliques widely spreading to pendulous, glabrous, curved inward, nerved at base or usually nerveless, 4–6 cm. long, 1.2–2 mm. wide; stigma sessile; seeds orbicular, winged all around, 1–1.5 mm. broad, uniseriate.—Proc. Am. Acad. **22:** 467 (1887) and in Gray, Syn. Fl. N. Am. **1:** 165 (1895); Coville in Contrib. U. S. Nat. Herb. **4:** 61 (1893); Rydberg, Fl. Rky. Mts. 360 (1918) in part; Jepson, Man. Fl. Pl. Calif. 431 (1925) and Fl. Calif. **2:** 70 (1936), excluding var. *longipes;* Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Munz, Man. So. Calif. Bot. 204 (1935). *A. arcuata,* var. *perennans* (Watson) M. E. Jones in Proc. Calif. Acad. Sci. **5:** 621 (1895). *A. gracilenta* Greene in Pittonia **4:** 194 (1900); Rydberg, Fl. Rky. Mts. 362 (1918) in part. *A. eremophila* Greene in Pittonia **4:** 194 (1900); Coulter & Nelson, New Man. Rky. Mts. 227 (1909) in part; Rydberg, op. cit. p. 361 in part. *A. recondita* Greene in Pittonia **4:** 195 (1900). *A. angulata* Greene ex Wooton & Standley in Contrib. U. S. Nat. Herb. **16:** 123 (1913); Wooton & Standley in Contrib. U. S. Nat. Herb. **19:** 280 (1915). *A. Fendleri* sensu Wooton & Standley, ibid. in part.—Colorado and New Mexico to Nevada, California and Baja California. MAP 3. COLORADO: 2 miles west of Rifle, Garfield Co., May, 1938, *Rollins 2203* (G, R); 4 miles south of Mesa, Mesa Co., May, 1938, *Rollins 2187* (G, R); 3 miles northeast of Cedaredge, Delta Co., May, 1938, *Rollins 2148* (G, R); 10 miles south of Montrose, Montrose Co., May, 1938, *Rollins 2128* (G, R); Naturita, Montrose Co., April, 1914, *Payson 231* in part (G, RM); 10 miles northeast of Ridgeway, Ouray Co., Sept., 1937, *Rollins s.n.* (R). NEW MEXICO: Santa Fe, May, 1897, *A. A. & E. G. Heller 3562* (ND, TYPE; G, isotype of *A. gracilenta.* This number at the Missouri Botanical Garden is

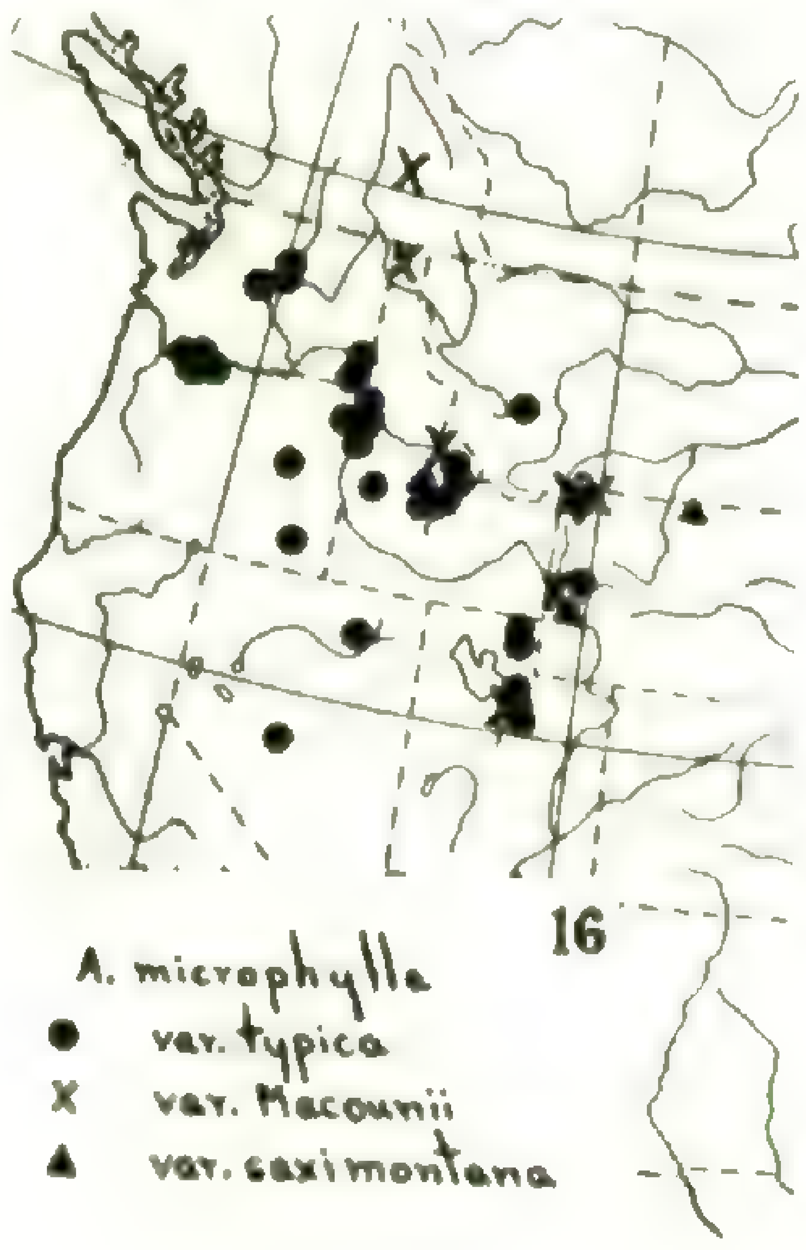


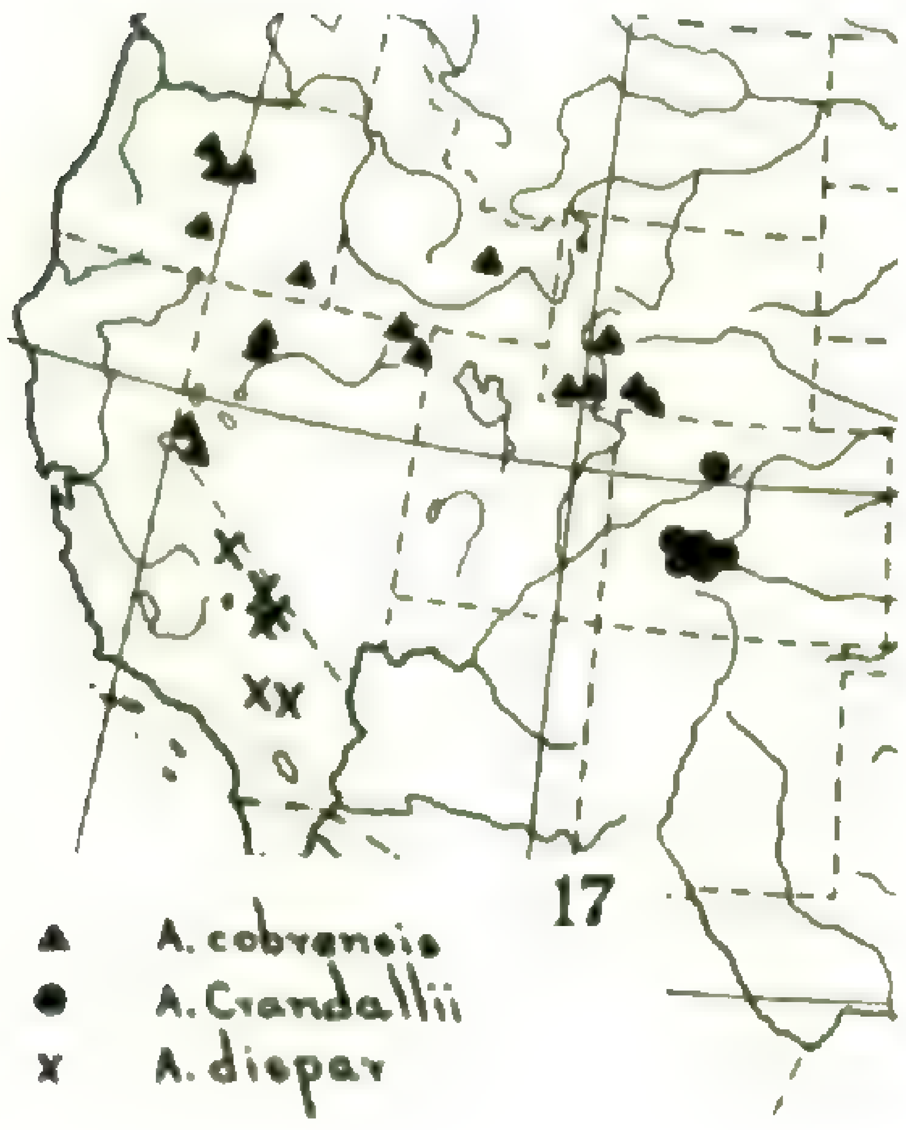


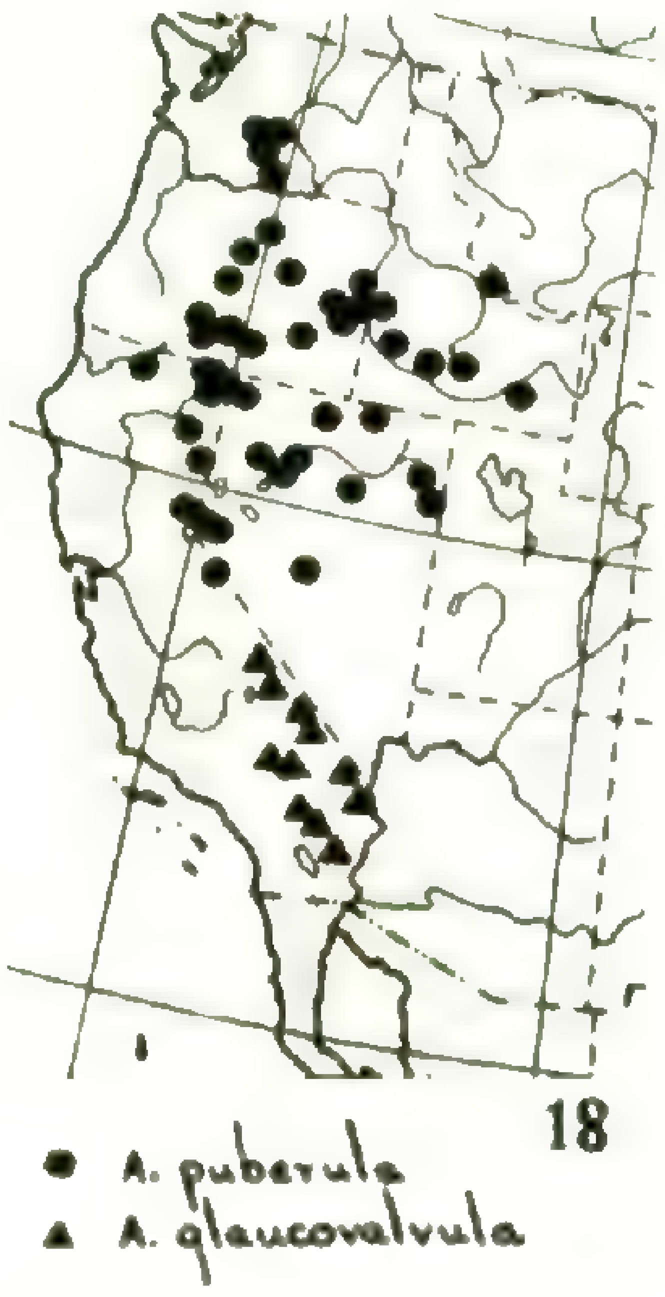


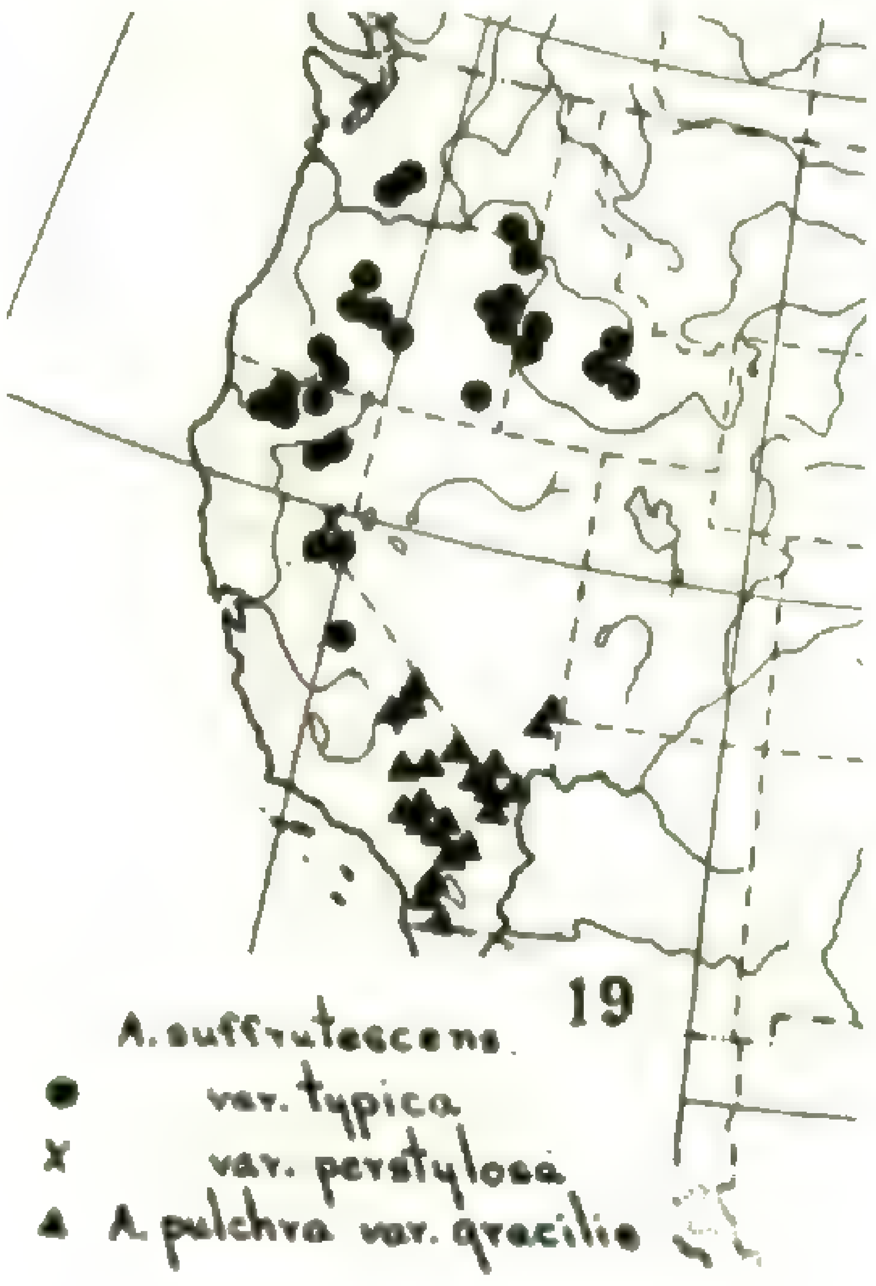












Rollins on Arabis

A. Fendleri); Mangas Springs, April, 1903, *Metcalfe 12* (US, TYPE; G, NY, isotypes of *A. angulata*); Mangas Springs, April, 1880, *Rusby 11* (M); east of Lordsburg, 1913, *M. E. Jones 25825* (P). UTAH: near Bluff, San Juan Co., April, 1936, *Maguire 15044* (G, UAC); Wah Wah Pass, west of Milford, Beaver Co., April, 1934, *Hutchings & Stahmann s.n.* (FS); Silver Reef, Washington Co., 1894, *M. E. Jones 5152* (P, RM, UC); Virgin, Washington Co., May, 1923, *C. L. Hitchcock 3027* (G); east of Hurricane, May, 1932, *Maguire & Blood 1396* (G, UAC); Zion National Park, April, 1934, *Maguire & Blood 4818* (UAC); St. George, April, 1880, *M. E. Jones 1650* (P, US). NEVADA: about 10 miles south of Austin, Lander Co., June, 1937, *Goodner & Henning 139* (NA, R); north of Nelson, Clark Co., April, 1919, *Tidestrom 8773* (G); Charleston (Spring) Mts., June, 1926, *Jaeger s.n.* (P); Deadman's Canyon, Sheep Mts., Clark Co., May, 1940, *Alexander & Kellogg 1606* (R). ARIZONA: Bright Angel Point, Grand Canyon, July, 1938, *Rollins & Chambers 2442* (G, R); south rim of the Grand Canyon, May, 1938, *A. & R. Nelson 2791* (G); Diamond Creek Canyon (probably Mohave Co.), 1893, *N. C. Wilson s.n.* (ND, TYPE of *A. recondita*; photo in Gray Herb.); Oatman-Kingman, Mohave Co., March, 1931, *Harrison & Kearney 7600* (P); Peach Springs, Mohave Co., April, 1893, *N. C. Wilson s.n.* (ND, TYPE of *A. eremophila*; photo in Gray Herb.); Mt. Ord, Apache Co., May, 1935, *Peebles & Smith 11526* (Sac); south of Safford, Graham Co., March, 1935, *Maguire et al. 10156* (R, UAC); Batatakin, Navajo Co., *Wetherill 346* (US); 1 mile south of Seneca Creek, Globe-Showlow, Gila Co., April, 1938, *Foster & Arnold 271* (G); Superstition Mts., Pinal Co., Feb., 1932, *Gillespie 8790* (G); below Coolidge Dam, Pinal Co., April, 1935, *Maguire 10441* (UAC); Sierra Estrella, Maricopa Co., March, 1935, *Peebles & Smith 10726* (G); Santa Catalina Mts., Pima Co., April, 1881, *Pringle s.n.* (G, TYPE; M, isotype), March, 1926, *Peebles, Harrison & Kearney 1435* (Sac); Tucson, Pima Co., March, 1919, *Eastwood 8120* (G). CALIFORNIA: Panamint Mts., April, 1891, *Coville & Funston 611* (G), June, 1928, *J. T. Howell 2903* (G); north slope of the San Bernardino Mts., May, 1882, *S. B. & W. F. Parish 1301* (G); near Goffs, San Bernardino Co., April, 1928, *Ferris 7263* (P); Providence Mts., May, 1920, *Munz et al. 4256* (P, Peirs, RM, UC); 4th of July Canyon, New York Mts., San Bernardino Co., May, 1940, *Alexander & Kellogg 1317* (R); Coyote Canyon, Riverside Co., April, 1902, *Hall 2869* (G); near Tahquitz Camp, east of Palm Springs, Riverside Co., April, 1919, *Peirson 660* (Peirs); Borego Valley, San Diego Co., May, 1929, *Munz & Hitchcock 11358* (P); Laguna Mts., San Diego Co., May, 1925, *Munz 9678* (P). BAJA CALIFORNIA: Tecate,

May, 1925, *Munz 9591* (P); San Pedro Martir, May, 1893, *T. S. Brandegee s.n.* (G).

A. perennans is found principally in an area bordering the Colorado River drainage in the southwestern United States, but the range extends slightly in all directions. Although it has been reported from as far north as the state of Washington,[1] the species is not known from authentic material north of western Colorado. The Vasey collection (*Vasey no. 201* collected in 1889) upon which Piper based his Washington report is so nearly identical with a specimen from San Diego Co., California, made by Orcutt in 1889 that one is led to suspect them to be one and the same collection.[2] In any case, it is almost certain that the Vasey specimen did not come from Washington.

In the southern portion of its range, *A. perennans* usually has broader, more obtuse basal leaves than in the northern portion. Also, there is some variation in the degree of toothing of the basal leaves. Often the inner leaves are entire and in rare instances all the basal leaves lack any evidence of being dentate. The variation in pedicel-length is noticeable, yet all degrees between 1 and 2 cm. may be found in any sizeable collection of the species.

Several names have been proposed for variants of *A. perennans*, but in each case there are no fundamental characters by which they can be consistently separated. Of the synonyms listed, the type of *A. gracilenta* is perhaps more distinctive than any of the others because of the entire basal leaves. However, this character is not significant when a gradual transition from entire to dentate or repand basal leaves is so obvious as in *A. perennans*. The type of *A. angulata* has especially slender and long pedicels but, as in the case of the basal leaves, we are dealing with an organ which normally has a rather wide range of variation. One near relative of *A. perennans* is *A. Fendleri*, which may be distinguished by its small, nearly wingless, biseriate seeds and large acicular trichomes along the margins of the basal leaves. *A. lignifera*, a plant with a very fine, dense pubescence on the leaves and stems, short, abruptly recurved

[1] Piper in Contrib. U. S. Nat. Herb. **11**: 294 (1906).

[2] In the *Cruciferae* one other collection of this series attributed to the state of Washington (*Vasey 192* in 1889) belongs to *Caulanthus simulans* Pays., a species not known north of southern California.

pedicels and entire leaves, is also related. *A. perennans* often develops a ligneous, elongated caudex which elevates the basal leaves from the ground-surface. The plants often grow intermixed with desert shrubs from which they derive mechanical support.

25. A. GRACILIPES Greene. Perennial, usually with a single robust stem from a simple caudex; stem simple or branched above, densely hirsute below with simple or rarely forked trichomes, glabrous above, 6–9 dm. high; basal leaves oblanceolate to slightly narrower, obtuse, dentate, coarsely pubescent with forked trichomes, 4–6 cm. long, 8–15 mm. broad, cauline lanceolate with a sagittate base, 3–5 cm. long, 5–10 mm. wide, lower imbricated, pubescent and dentate, upper hardly overlapping, entire and glabrous; sepals oblong, glabrous or with a few trichomes near apex, non-saccate, 5–6 mm. long, 1.5 mm. wide; petals narrowly lingulate, pink, 8–10 mm. long, about 2 mm. wide, rounded at apex, not effectively differentiated into blade and claw; glandular tissue continuous beneath all stamens, moderately developed; pedicels very slender, glabrous, ascending but often arching downward on the outer portion, 2–4 cm. long; infructescence 3–4 dm. long; siliques pendulous, glabrous, nerved below, 4–8 cm. long, about 2 mm. wide; stigma sessile; ovules biseriate, mature seeds not seen.—Pittonia **4:** 193 (1900). *A. arcuata* (Nutt.) Gray, var. *longipes* Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895). *A. perennans* Watson, var. *longipes* (Wats.) Jepson, Fl. Calif. **2:** 70 (1936).—MAP 9. ARIZONA: Flagstaff, Coconino Co., May, 1893, *N. C. Wilson s.n.* (ND, TYPE; photo in Gray Herb.); about Mormon Lake, Coconino Co., June, 1898, *MacDougal 60* (G, US); hot, sandy canyons, Williams, Coconino Co., April, 1924, *Nelson 10244* (G, M, RM); Williams to Ashfork, Coconino Co., April, 1930, *Loomis 6928* (Sac); Fort Mohave, April, 1884, *Lemmon 4184* (G, TYPE of *A. arcuata*, var. *longipes*); rim of Pueblo Canyon, Sierra Ancha, Gila Co., May, 1931, *Harrison 7883* (Sac); near Prescott, Yavapai Co., April, 1936, *McLellan & Stitt 815* (Sac); 6 miles west of Prescott, Yavapai Co., April, 1934, *Mrs. F. M. Stone s.n.* (NY).

This species is more closely related to *A. Fendleri* than to *A. perennans,* as has been indicated by the treatments of Jepson[1] and Munz.[2] From *A. Fendleri* it may be distinguished by the numerous, large, imbricated cauline leaves, the extremely long, slender pedicels and the usually single-stemmed habit. *A. Fend-*

[1] Fl. Calif. **2:** 70 (1936).
[2] Man. So. Calif. Bot. 204 (1935).

leri, in addition to having the leaf-blades covered with trichomes similar to those of *A. gracilipes*, has the leaf-margins ciliate. In the latter species the leaf-margins are never ciliate. *A. gracilipes* has more numerous flowers and the infructescence is more elongated than that of either *A. Fendleri* or *A. perennans*.

26. A. sparsiflora Nuttall. Perennial; stems one to several from a simple or branching caudex, usually stout, simple or branched above, pubescent below with spreading or appressed trichomes (often glabrous in var. *atrorubens*) pubescent or glabrous above, (2.5–) 3–9 dm. high; basal leaves numerous, linear-oblanceolate to broader, usually acute, rarely obtuse, entire to irregularly dentate, harshly pubescent with coarse dendritic trichomes on both surfaces or the trichomes somewhat finer, 3–10 cm. long, 3–6 (–10) mm. wide; cauline leaves approximate, linear-lanceolate to broadly lanceolate, entire or the lower dentate, sagittate-auriculate, 2–8 cm. long, 3–6 (–10) mm. wide, usually obtuse, lower densely pubescent (glabrous or nearly so in var. *atrorubens*), upper pubescent or glabrous; sepals oblong, pubescent to sparsely so, 4–6 mm. long, 1.5–2 mm. wide, callose at base; petals pink to purple, spatulate (6–) 8–14 (–15) mm. long, 2–4 mm. wide; glandular tissue subtending all stamens, moderately developed; fruiting raceme elongated; pedicels divaricately ascending to spreading at right angles, often stout, pubescent with spreading or appressed trichomes or glabrous, 5–15 mm. long; siliques divaricately ascending to arcuately descending, slightly curved to strongly arcuate, glabrous, nerved below the middle, obtuse, 6–12 cm. long, 1.5–2 mm. wide; stigma sessile or nearly so; seeds orbicular, narrowly winged, uniseriate.

Key to the Varieties of A. sparsiflora

a. Pedicels hirsute with spreading trichomes or glabrous, fruiting pedicels divaricately ascending to pendulous; lower stems hirsute with spreading trichomes or rarely glabrous . . . . b.
b. Petals white, 6–8 mm. long; Montana to British Columbia and Yukon . . . . 26f. Var. *columbiana*.
b. Petals pink to purple, 8–15 mm. long; plants south of British Columbia and Montana . . . . c.
c. Upper leaves and stems glabrous to very sparsely hirsute . . . . d.
d. Basal leaves entire, linear-oblanceolate; pedicels divaricately ascending, glabrate; stems usually branched above; Idaho and northern Utah to Oregon and northeastern California . . . . 26a. Var. *typica*.
d. Basal leaves dentate, oblanceolate to broader; pedicels horizontal to somewhat ascending, hirsute or glabrous; stems rarely branched above . . . . e.
e. Pedicels horizontal, usually hirsute; siliques strongly arcuate, widely spreading, nerved; widely dis-

tributed from northern California to Washington and eastward to the Rky. Mountains. .26d. Var. *subvillosa*.
e. Pedicels ascending, glabrous; siliques only slightly arcuate, nearly nerveless; south central Washington................................26e. Var. *atrorubens*.
c. Upper leaves and stems hirsute; basal leaves linear-lanceolate, acute, coarsely pubescent; California. 26b. Var. *arcuata*.
a. Pedicels pubescent with closely appressed trichomes, fruiting pedicels usually widely pendulous; stems densely pubescent throughout with appressed trichomes; southern California to northern Baja California..........26c. Var. *californica*.

26a. Var. **typica.** Caudex often branched; stems fairly slender, simple or branched above, hirsute below, glabrate above; basal leaves long-petioled, entire; cauline leaves linear-oblong, obtuse, lower densely pubescent, upper glabrate; pedicels ascending, loosely pilose or rarely almost glabrous; siliques often only slightly arcuate but sometimes strongly so.—*A. sparsiflora* Nuttall in T. & G. Fl. N. Am. **1:** 81 (1838). *A. peramoena* Greene in Fedde, Repert. Nov. Sp. **5:** 242 (1908). *A. arcoidea* Nelson in Bot. Gaz. **53:** 220 (1912). *A. sparsiflora*, var. *peramoena* (Greene) Rollins in Res. Stud. State Coll. Wash. **4:** 25 (1936).—Idaho and northern Utah to California and Oregon. Map 13. Locality uncertain: R(ocky) Mts., *Nuttall s.n.* (Ph, isotype; photo of type in Gray Herb.). Idaho: St. Anthony, Fremont Co., May, 1919, *Quayle 19* (Cl, P, RM, US); Rexburg Butte, Madison Co., June, 1938, *Davis 308* (R); Little Lost River, Butte Co., May, 1938, *Davis 162* (R); Pocatello, Bannock Co., April, 1937, *Leiniger s.n.* (R); Picabo, Blaine Co., June, 1916, *Macbride & Payson 2979* (G, RM, US); New Plymouth, Payette Co., (formerly Canyon Co.), May, 1910, *Macbride 87* (RM, type; G, M, isotypes of *A. arcoidea*). Utah: Logan Canyon, Cache Co., May, 1932, *Maguire 3440* (UAC). Nevada: south of Secret, base of Ruby Range, Elko Co., June, 1937, *Nichols & Lund 99* (R); summit of Slumbering Hills, Humboldt Co., June, 1937, *Train 151* (G, R); Vya Spring, Vya, Washoe Co., May, 1939, *Train 2774* (NA, R); Mt. Rose, Washoe Co., July, 1913, *Heller 10943* (G, NY); Galena Creek, Washoe Co., Aug., 1906, *Kennedy 1248* (M); 2 miles west of Reno, April, 1910, *Heller 9993* (P, UC). California: near Lost Lake, Modoc Co., June, 1934, *J. T. Howell 12138* (G); Honey Lake, June, 1892, *Brandegee s.n.* (UC); Susanville, Lassen Co., June, 1897, *M. E. Jones s.n.* (P); Doyle Station, Lassen Co., May, 1911, *Eggleston 6727* (G). Oregon: Powder River, May, 1886, *Cusick 1348* (G); Forked Horn Butte, Deschutes Co., May, 1921, *Whited 22* (G, US); Camp Harney, Harney Co., May, 1885, *T. Howell 335* (G); Dry Creek, Crook Co., June, 1894, *Leiberg 340* (G, UC); Willow Creek, Malheur Co., May, 1900, *Cusick 2369* (US, type; G, NY, O, RM, WSC, isotypes of *A. peramoena*); Burns, Malheur Co.,

June, 1912, *Peck 2703* (G, W); Beulah, Malheur Co., June, 1896, *Leiberg 2310* (G, UC, US).

26b. Var. ARCUATA (Nuttall) Rollins. Usually woody at base; stem pubescent throughout, lower portion hirsute with large simple or branched trichomes; basal leaves linear-oblanceolate, acute, often borne on sterile shoots, coarsely pubescent; pedicels spreading, pubescent; siliques strongly arcuate.—Res. Stud. State Coll. Wash. **4:** 26 (1936). *Streptanthus arcuatus* Nuttall in T. & G., Fl. N. Am. **1:** 77 (1838). *Arabis arcuata* (Nuttall) Gray in Proc. Am. Acad. **6:** 187 (1864); Watson in King, Geol. Expl. Fortieth Parallel **5:** 18 (1871); Brewer & Watson, Bot. Calif. **1:** 23 (1876) in part; Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895) in part; Jepson, Fl. Calif. **2:** 69 (1936) in part, not *A. arcuata* Shuttlw. (1852). *A. Holboellii*, var. *arcuata* (Nuttall) Jepson, Man. Fl. Pl. Calif. 430 (1925). *A. maxima* Greene, Pittonia **4:** 192 (1900); Munz, Man. So. Calif. Bot. 205, fig. 102 (1935) in part. *A. arcuata*, var. *rubicundula* Jepson? Fl. Calif. **2:** 69 (1936).—MAP 13. CALIFORNIA: Sierra City, Sierra Co., June, 1938, *Constance 2302* (R); near Folsom, Sacramento Co., April, 1928, *Copeland 897* (P); Yosemite Valley, June, 1911, *Abrams 4483* (P); Mather, Tuolumne Co., May, 1931, *Keck 1124* (G, M); near Tollhouse, Fresno Co., May, 1938, *Constance 2213* (R); Hobo Hot Springs, Kern Co., April, 1938, *Constance & Mason 2120* (R); Mt. Day, Santa Clara Co., April, 1938, *Heller 8935* (G); near North Fork, Madera Co., May, 1938, *Eastwood & Howell 5420* (G, R); Big Tree Canyon, Tulare Co., July, 1891, *Coville & Funston 1350* (G); San Antonio Mts., May, 1918, *Johnston 1952* (G); Santa Barbara, *Nuttall s.n.* (G, isotype); Mt. Wilson, July, 1915, *Macbride & Payson 880* (G); 5 miles west of Julian, April, 1932, *Johansen & Ewan 7159* (P).

26c. Var. **californica,** var. nov. Herba perennis; caulibus robustis pubescentibus, pilis ramosis adpressis; petalis purpureis; pedicellis pubescentibus.

Stems coarse, pubescent throughout with fine dendritic trichomes; basal leaves large, coarsely toothed, densely pubescent with moderately fine dendritic trichomes; pedicels pubescent with appressed trichomes; petals deep purple.—*A. arcuata* sensu Brewer & Watson, Bot. Calif. **1:** 23 (1876) in part; Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895) in part; Jepson, Fl. Calif. **2:** 69 (1936) in part. *A. maxima* sensu Munz, Man. So. Calif. Bot. 205 (1935) in part.—Southern California and adjacent Baja California. MAP 14. CALIFORNIA: Mt. Lowe, near Dawn Station, Los Angeles Co., May, 1918, *Peirson 62* (Peirs); San Antonio Canyon Wash between Claremont and Upland, April, 1918, *Johnston 1973* (Cl, G, UC); 18 miles from Banning, Riverside Co., May, 1924, *Munz 8136* (G); Santa Rosa Mts., River-

side Co., May, 1937, *Munz 15085* (G); Warner's Hot Springs, San Diego Co., April, 1913, *Eastwood 2821* (G); near Campo, San Diego Co., May 24, 1903, *L. R. Abrams 3563* (G, TYPE; UC, isotype). MEXICO: 9 miles southeast of Tecate, Baja California, May, 1925, *Munz 9478* (P).

26d. Var. **subvillosa** (Watson) comb. nov. Stems hirsute below with large simple or branched trichomes, glabrous above; basal leaves dentate or very rarely entire, acute, harshly pubescent; pedicels spreading at right angles to rachis, hirsute; siliques arcuate.—*A. arcuata*, var. *subvillosa* Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895). *A. sparsiflora* sensu Howell, Fl. Northw. Am. **1:** 43 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 294 (1906); Rollins in Res. Stud. State Coll. Wash. **4:** 23 (1936). *A. campyloloba* Greene, Pittonia **4:** 192 (1900). *A. elegans* Nelson in Bot. Gaz. **30:** 192 (1900). *A. perelegans* Nelson in Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909); Rydberg, Fl. Rky. Mts. 361 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925). *A. polytricha* Greene, Leaflets **2:** 72 (1910). *A. subserrata* Greene, Leaflets **2:** 79 (1910). *A. retrofracta* sensu Jepson, Fl. Calif. **2:** 67 (1936) in part.—Montana and Wyoming to California and Washington. MAP 14. MONTANA: Jack Creek, July, 1897, *Rydberg & Bessey 4222* (NY). WYOMING: Undine Falls, Yellowstone National Park, July, 1897, *A. & E. Nelson 5676* (G, RM), July 6, 1899, *A. & E. Nelson 6939*[1] (RM, TYPE of *A. elegans & A. perelegans*); 5 miles west of Beartooth Lake, Park Co., *Rollins & Muñoz 2856* (G, R). IDAHO: Edgemere, Bonner Co., June, 1923, *Large 54* (WSC); Albany Falls, Kootenai Co., May, 1923, *Sprague 399* (WSC); North Fork of the Salmon River, Lemhi Co., June, 1938, *Davis 428* (R); Shoup, 1919, *Kemp 60* (NY); Clearwater, *Spalding s.n.* (G); 6 miles south of Craigmont, Lewis Co., June, 1936, *Rollins 1118* (G, R); Martin, Blaine Co., July, 1916, *Macbride & Payson 3089* (G); Lake Waha, Nez Perce Co., June, 1896, *Heller & Heller 3173* (M, UC, US); near Sheep Creek, lower slopes of the Seven Devils Mts., Snake River Canyon, Idaho Co., May, 1936, *Moore 74* (G, R); Twin Springs, Elmore Co., May, 1937, *Buffat & Murdock s.n.* (G, R); Shoshone Falls, Lincoln Co., May, 1912, *Bennitt 57* (RM); Silver City, Owyhee Co., June, 1911, *Macbride 934* (RM). UTAH: 18 miles north of Vernal, Uintah Co., June, 1937, *Rollins 1760* (DS, G, R). NEVADA: San Juan Creek Canyon, Nye Co., June, 1937, *Goodner & Henning 395* (R); head of Summit Lake Creek, Humboldt Co., June, 1939, *Train 3040* (NA); Hunter Creek Canyon, Washoe Co., July, 1913, *Kennedy 3039* (G); Reno, June, 1897,

[1] No. 5680 was published as type, but the same number was cited as type of *A. densicaulis*. This number was found marked type in the Rocky Mountain Herbarium.

M. E. Jones s.n. (UAC). California: dry hills near Yreka, Siskiyou Co., May, 1908, *Butler 723* (ND, type; P, UC, isotypes of *A. polytricha*); Salmon River Canyon, Siskiyou Co., July, 1937, *Howell 13569* (G, R); Hornbrook, April, 1913, *L. E. Smith 104* (G); Igerna-Weed, June, 1905, *Heller 8083* (G); near Yreka, April & May, 1876, *Greene 695* (ND, type of *A. campyloloba*; photo in Gray Herb.); Mt. Shasta, June, 1939, *Cooke 13563* (G, R); Devils Backbone, Humboldt Co., July, 1935, *Tracy 14391* (UC); Red Clover Valley, July, 1907, *Heller & Kennedy 8713* (G). Oregon: Ice Lake Trail, Wallowa Mts., June, 1936, *Eastwood & Howell 3321* (R); head of Horse Creek, Wallowa Co., June, 1897, *Sheldon 8356* (M, RM); Pine Creek near Snake River, May, 1901, *Cusick 2518* (G, M, O, RM, UC, US); Owyhee, Mathew Divide, June, 1896, *Leiberg 2206* (G); Service Creek, Wheeler Co., May, 1925, *Henderson 5061* (G); near Lakeview, June, 1928, *Constance* (Henderson 9527) (O); Gearhart Mt., June, 1928, *Constance* (Henderson 9528) (O, WSC); Klamath Falls, Klamath Co., May, 1928, *Applegate 3506* (G, UC); rocky south slope of Siskiyou Mts., 3 miles north of Oregon-California boundary, Jackson Co., June, 1940, *Beetle & Constance 2621* (R). Washington: Bead Lakes, Pend Oreille Co., May, 1923, *Sprague 400* (WSC); Spokane, May, 1898, *Piper 2821* (G); Malden-Pine City, May, 1936, *Rollins & Constance 1093* (DS, G, R); Rock Lake, May, 1936, *Rollins & Constance 1100* (G, R, WSC); east of Coulee Dam, Grant Co., April, 1935, *Rollins 860* (G, R, RM, UC, US, WSC); Kamiak Butte, Whitman Co., June, 1936, *Constance & Clements 1800* (G, R); Pullman, Whitman Co., May 20, 1894, *Piper 1812* (G, type); above Anatone, Asotin Co., June, 1937, *Constance et al. 1875* (G, R); west of Ventura, Okanogan Co., May, 1936, *Edwards 237* (G, R); 10 miles east of Davenport, Lincoln Co., June, 1940, *Constance & Beetle 2748* (G); Ellensburg, Kittitas Co., April, 1897, *Whited 312* (US, type; WSC, isotype of *A. subserrata*); Rattlesnake Mts., Yakima Co., 1902, *Cotton 562* (G); Klickitat River, May, 1894, *Suksdorf s.n.* (G, M, WSC).

26c. Var. atrorubens (Greene) Rollins. Stems usually single, simple, glabrous to sparsely pubescent at the base; basal leaves spatulate to widely oblanceolate, irregularly dentate, thinly pubescent with dendritic trichomes; cauline leaves glabrous or the lower sparsely pubescent, somewhat dentate, the upper entire; pedicels divaricately ascending, glabrous to sparsely pilose; petals deep purple; siliques divaricately ascending to more widely spreading, nerveless.—Res. Stud. State Coll. Wash. **4:** 26 (1936). *A. atrorubens* Greene in Erythea **1:** 223 (1893); Watson in Gray, Syn. Fl. N. Am. **1:** 162 (1895); Howell, Fl. Northw. Am. **1:** 43 (1897); Piper in Contrib. U. S. Nat. Herb.

11: 294 (1906). *A. atriflora* Suksdorf in Deutsch. Bot. Monatsschr. **15:** 211 (1897.—South central Washington. MAP 13. WASHINGTON: Rattlesnake Hills, Ellensburg, Kittitas Co., May, 1932, *Thompson 8254* (G); near Virden, Kittitas Co., May, 1935, *Thompson 11469* (G, T, UW); Darling Mts., Yakima Co., June, 1899, *Flett 1137* (WSC); Yakima Indian Reservation, April, 1932, *Heidenreich 68* (WSC); high prairie near Goldendale, June, 1926, *Suksdorf 12024* (R, WSC); western Klickitat Co., May, 1892, *Suksdorf 2105* (G, UC, US, WSC, isotypes).

26f. Var. **columbiana** (Macoun) comb. nov. Stems one to several, sparsely hirsute below, glabrous above; petals white, 6–8 mm. long; pedicels hirsute with spreading trichomes; siliques arcuate.—*A. columbiana* Macoun, Cat. Canad. Pl. **2:** 304 (1890).—Montana, British Columbia and Yukon. MONTANA: Rockwall Basin, 12 miles northwest of Wilsall, Park Co., July, 1921, *Suksdorf 362* (R, WSC). BRITISH COLUMBIA: Yale, May 17, 1889, *Macoun 1677* (Can.); Fraser River Canyon, May, 1938, *J. W. & E. M. Thompson 19* (G); Vancouver Island, May 9, 1875, *Macoun s.n.* (Can). YUKON: Atlin, July, 1914, *Eastwood 638a* (G).

Arabis sparsiflora is a complex species occupying a wide geographic area and many different habitats. An attempt to organize the leading variants of the species inevitably led to the recognition of several varieties. These have been called species by some botanists, but they certainly do not parallel the other species of the genus as defined in the present work. Each variety is recognizable if carefully observed and its geographic area taken into consideration. However, there is no sharp morphological distinction which may be used as a basis for their being placed into entities of a higher order.

I have examined a photograph of the type of *A. sparsiflora* and studied an isotype at the Philadelphia Academy of Sciences. Although only the upper part (about one half) of the plants are represented in each case, the pubescence of the cauline leaves and spreading trichomes on the stem as well as the form and position of the siliques are distinctive and give clues as to their identity. These plants are matched by specimens from Idaho, Oregon and Nevada which I formerly called *A. sparsiflora*, var. *peramoena*. Thus a slight rearrangement of my former[1] interpretation of the varieties of *A. sparsiflora* is necessary. Those plants treated before as typical *A. sparsiflora* are actually var.

[1] Res. Stud. State Coll. Wash. **4:** 23–27 (1936).

subvillosa. A type for var. *subvillosa* was not designated by Watson or by Robinson who revised Watson's manuscript of *Arabis* before it was actually published in the Synoptical Flora. I have arbitrarily selected Piper's no. 1812 from Pullman, Washington, as type. The specimen answers the description of var. *subvillosa* and was undoubtedly one of those upon which the variety was based.

Variety *arcuata* and var. *californica* are very similar except for a few minor characters. The former has a very coarse, dense pubescence, and the trichomes on the pedicels and lower stems are spreading. The basal leaves are nearly linear and very often entire. In var. *californica* the pubescence is finer and appressed throughout. The basal leaves are oblanceolate to broader and usually dentate. Var. *arcuata* seems to be more or less confined to the mountains, whereas var. *californica* is usually at the base of mountain-ranges or on lower slopes nearer the desert. I have not seen the type of *A. arcuata*, var. *rubicundula* Jepson, but Heller's specimen no. 8935 from Mt. Day, its type-locality, is var. *arcuata*. Assuming the two plants to be the same, I am hesitatingly referring var. *rubicundula* to the older var. *arcuata*.

Greene in Erythea, l. c., described *A. atrorubens* attributing it to "Suksdorf in herb." Ordinarily the authorship of this epithet would be given as Suksdorf ex Greene. However, Suksdorf writing four years after the original publication disclaimed the name *atrorubens* and proposed the new *atriflora*. Since Suksdorf's action was positive, it seems wise to consider Greene as sole author of the species. With this interpretation, the specimen in Greene's Herbarium must be designated type, not the specimen at Washington State College, as I have previously indicated.

It is difficult to determine which of Macoun's specimens is the actual type of var. *columbiana*. He says the plant is "quite common on the lower slopes of the mountains bordering the Thompson and Fraser rivers from Spence's Bridge to Yale, B. C. First detected May 19, 1875". The only specimen sent from the National Herbarium of Canada answering the description of var. *columbiana* and nearly agreeing with the date of the presumed type-specimen is the one from Vancouver Island

cited above. This obviously is not the type nor is Macoun's no. 1677 from Yale, B. C. The latter specimen, however, undoubtedly represents the entity Macoun had in mind, therefore I am using it temporarily as a point of reference for the variety.

27. A. Hoffmannii (Munz) Rollins. Perennial, often coarse; caudex scaly, usually invested in old leaf-bases, woody; stems one to several, branched above, glabrous or very sparsely pubescent below, 5–7 dm. high; basal leaves numerous, crowded, linear-lanceolate to slightly broader, sinuate-dentate, obtuse, glabrous or nearly so above, pubescent with dendritic trichomes below, coriaceous, 5–10 cm. long, 6–10 mm. wide, mid-rib wide and prominent; petiole widely winged to base; cauline leaves sessile, crowded, linear-oblong, obtuse, auriculate and somewhat clasping, green and glabrous above, pubescent below, 3–6 cm. long, 4–6 mm. wide; sepals oblong, obtuse, green, glabrous to very sparsely pubescent, 4–5 mm. long; petals linear-oblong, slightly narrowed toward base, white, 8–10 mm. long; fruiting raceme greatly elongated; pedicels divaricately ascending, glabrous, 1–4 cm. long; siliques divaricate, straight or usually becoming slightly arcuate, glabrous, thick and coriaceous, nerveless, obtuse, 6–10 cm. long, 2–3.5 mm. wide; style nearly obsolete or short and stout; seeds orbicular, narrowly winged, about 1 mm. broad, biseriate.—Madroño **3:** 360 (1936). *A. maxima* Greene, var. *Hoffmannii* Munz in Bull. So. Calif. Acad. Sci. **31:** 63 (1932).—Santa Cruz Island, California: without definite locality, April, 1888, *T. S. Brandegee s.n.* (UC); ledges in sea cliffs, east of Dick's Harbor, Feb., 1932, *R. Hoffmann 653* (P, type), May, 1932, *R. Hoffmann s.n.* (P).

This species is remarkable for its greatly elongated pedicels, leathery nerveless siliques and very thick basal leaves. The species is related to *A. sparsiflora*, var. *arcuata*, but seems amply distinct on the basis of a number of characters. *A. Hoffmannii*, so far as known, is completely insular.

28. A. Breweri Watson. Caespitose perennial; stems several to numerous from a much-branched, woody caudex, simple, densely hirsute below with simple or rarely forked, spreading trichomes, often glabrous above, 6–20 cm. high; basal leaves broadly spatulate, entire to remotely few-toothed, obtuse, short-petioled, pubescent on both surfaces with usually three-forked hairs, 1–3 cm. long, 4–6 mm. wide, rarely larger; cauline leaves sessile, auriculate, oblong to oblong-lanceolate, pubescent, 1–2 (–3) cm. long, 4–6 (–10) mm. wide; sepals oblong, obtuse, pubescent, often purple-margined, or -tipped, non-saccate, 4–5 mm. long, 1–2 mm. wide; petals spatulate, reddish-purple to

pink, 7–10 mm. long, 3–4 mm. wide, tapering to a very narrow claw; glandular tissue on each side of single stamens and beneath paired stamens, nearly continuous; pedicels pubescent to rarely glabrous, 3–15 mm. long; siliques divaricate, arcuate to nearly straight, 3–7 cm. long, about 2 mm. wide, 1-nerved on the lower third of the valves; stigma sessile; seeds orbicular, narrowly winged, 1 mm. or slightly broader, uniseriate.

Key to the Varieties of A. Breweri

a. Pedicels 5–15 mm. long, hirsute or rarely glabrous; siliques 4–7 cm. long. . . . b.
  b. Petals 6–9 mm. long; cauline leaves usually less than 2 cm. long; pedicels 5–9 mm. long. . . . . .28a. Var. *typica*.
  b. Petals 10–13 mm. long; cauline leaves 2–4 cm. long; pedicels 10–15 mm. long. . . . . .28b. Var. *Austinae*.
a. Pedicels 3–4 mm. long, glabrous; siliques 2–3 cm. long 28c. Var. *pecuniaria*.

28a. Var. **typica.** *A. Breweri* Watson in Proc. Am. Acad. **11:** 123 (1875); Brewer and Watson, Bot. Calif. **1:** 33 (1876); Greene, Fl. Francis. 254 (1891); Watson in Gray, Syn. Fl. N. Am. **1:** 165 (1895); Howell, Fl. Northw. Am. **1:** 44 (1897); Jepson, Man. Fl. Pl. Calif. 431 (1925) and Fl. Calif. **2:** 65 (1936); Rollins in Res. Stud. State Coll. Wash. **4:** 22 (1936). *A. epilobioides* Greene in Fedde, Rep. Nov. Spec. **5:** 242 (1908). *A. rostellata* Greene, Leaflets **2:** 71 (1910). *A. Breweri* Wats., var. *figularis* Jepson, Fl. Calif. **2:** 65 (1936).—California and southern Oregon. Map 15. California: between Big Flat and Caribou Gulch, Siskiyou Co., *J. T. Howell 13568* (G, R); near Yreka, Siskiyou Co., April, 1934, *Eastwood & Howell 1762* (G, Peirs, R); north of Cabin Creek, Trinity Co., Aug., 1935, *Tracy 14529* (R, UC); Klamath River, Siskiyou Co., May, 1910, *Butler 1379* (M, P, RM, UC, US); Plumas County, 1880, *Austin s.n.* (G); Marysville Buttes, April, 1893, *Blankinship s.n.* (G); South Butte, Sutter Co., May, 1936, *J. & N. Ewan 9648* (R); Black Butte, Colusa Co., June, 1884, *Rattan 2* (G); Mt. Sanhedrin, Lake Co., July, 1902, *Heller s.n.* (US, type; G, M, Ph, isotypes of *A. epilobioides*); Elk Ridge, Mendocino Co., 1867, *Bolander 6561* (G, UC, US); Mt. Hood, Sonoma Co., March, 1902, *Heller & Brown 5190* (G, M, P, Ph, US); Mt. Diablo, Contra Costa Co., 1860–62, *Brewer 1086* (G, type; M, UC, WSC, isotypes); April, 1938, *Constance & Morrison 2192* (R); Mt. Hamilton, Santa Clara Co., May, 1907, *Heller 8617* (G, M, Ph, US); The Pinnacles, San Benito Co., March, 1930, *Mason 5524* (R), May, 1937, *J. T. Howell 12955* (G, R); Pico Blanco, Monterey Co., May-June, 1901, *Davy 7330* (UC); Tassajara, Monterey Co., June, 1901, *Dudley s.n.* (NY, US). Oregon: near Medford, Jackson Co., April, 1934, *Thompson 10319* (G, P, RM, T, US,

UW); Siskiyou Summit, Jackson Co., June, 1929, *Kildale 8314* (OS); Mt. Grayback, Josephine Co., June, 1904, *C. V. Piper 6156* (US, TYPE; G, W, isotypes of *A. rostellata*).

28b. Var. **Austinae** (Greene), comb. nov. Basal leaves entire to repand, 3–6 cm. long, 7–14 mm. broad, pubescent with large, spreading, dendritic trichomes; cauline leaves ample, 2–4 cm. long, 5–10 mm. broad, pubescent to nearly glabrous; sepals sparsely pubescent, purple, outer saccate, 5–7 mm. long; petals purple, spatulate, 10–13 mm. long, 3–4 mm. broad; pedicels 1–1.5 cm. long; siliques 5–7 cm. long, about 2 mm. broad.—*A. Austinae* Greene in Fedde, Rep. Nov. Spec. **5:** 242 (1908).—MAP 15. CALIFORNIA: Little Chico Canyon, Butte Co., March & April, 1896, *Mrs. R. M. Austin s.n.* (ND, TYPE); Little Chico Creek, March & May, 1896, *Mrs. R. M. Austin 868* (M); canyon of Chico Creek, below Ten Mile House, March, 1920, *Heller 13359* (M); rocks, Little Chico, Feb., 1897, *Mrs. C. C. Bruce 1945* (P).

28c. Var. **pecuniaria,** var. nov. Herba perennis; caulibus tenuibus 1–2 dm. altis; petalis 6–8 mm. longis; siliquis divaricatis 2–3 cm. longis, ca. 2 mm. latis; pedicellis glabris 3–4 mm. longis.—MAP 15. CALIFORNIA: rocky ledge, Dollar Lake, San Bernardino Mts., San Bernardino Co., August 24, 1922, *P. A. Munz 6238* (G, TYPE; P, Peirs, isotypes).

Plants from the northern portion of the range of *Arabis Breweri* are often taller, with straighter and more erect siliques, than those from nearer the type-station. These plants often have a perplexing mixture of the supposedly distinctive characters of both *A. Breweri* and *A. sparsiflora,* suggesting a possible hybrid origin. Plants of this sort were defined as var. *figularis* by Jepson, but I have been unable to discover characters which would consistently separate them from var. *typica. A. Breweri* is most closely related to *A. sparsiflora,* var. *arcuata,* with which it has many characteristics in common. For those who would consider *A. Lyallii* to be a variety of *A. Drummondi,* it would be necessary in order to be consistent, to place *A. Breweri* in a varietal category under *A. sparsiflora.*

Variety *Austinae* has larger leaves and flowers than var. *typica,* but the dimensions of the siliques and total height of the plants are similar. The very ample cauline and long basal leaves impart a distinctive growth-habit to var. *Austinae* which makes it easily recognized, even though the main points of its morphology are in agreement with the typical variety. Var. *pecuniaria* has cer-

tain traits in common with *A. Lemmoni* and may well be a remnant from a former series which linked the latter species with *A. Breweri.* Var. *pecuniaria* is isolated from typical *A. Breweri* and this isolation must have taken place very early because there is no evidence of intergrading characters between the two. That the variety should be associated with *A. Breweri,* rather than *A. Lemmoni,* there is little doubt.

29. A. Cusickii Watson. Perennial, caespitose; stems usually several, simple or rarely branched, erect to somewhat decumbent, hirsute below with large, spreading, simple trichomes, sparingly hirsute above to glabrous, 6–20 cm. high; basal leaves tufted, numerous, linear, acute, hirsute and somewhat ciliate, 1–3 cm. long, 2–3 mm. broad; cauline leaves linear to linear-lanceolate, sessile, not auriculate, 1–3 cm. long, 2–4 mm. broad; sepals oblong, hirsute, scarious-margined, non-saccate, 3.5–5 mm. long; petals spatulate, white to rose-colored, 6–10 mm. long, 2–3 mm. broad; glandular tissue weakly developed, continuous beneath all stamens; pedicels ascending, stout, glabrous to rarely sparsely hirsute, 5–15 mm. long; siliques arcuate-ascending, glabrous, nerved near the base, 4–8 cm. long, 2–3 mm. wide; stigma sessile; seeds orbicular, narrowly winged, 1–2 mm. broad, uniseriate.—In Proc. Am. Acad. **17:** 363 (1882) and in Gray, Syn. Fl. N. Am. **1:** 167 (1895); Howell, Fl. Northw. Am. **1:** 44 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906); Piper & Beattie, Fl. Southeastern Wash. Adj. Idaho 116 (1914); Rollins in Res. Stud. State Coll. Wash. **4:** 20, fig. 6 (1936); St. John, Fl. Southeastern Wash. Adj. Idaho 164 (1937). —Idaho, Oregon and Washington. Map 8. Idaho: Salmon, Lemhi Co., June, 1920, *E. B. & L. B. Payson 1832* (Cl, G); hills near Challis, Custer Co., April, 1915, *Work 516* (FS); Garden Creek, Custer Co., April, 1915, *Work 532* (FS); Sawyer Canyon, Lewis Co., June, 1936, *Rollins 1121* (G, R); Middle Fork of Weiser River, Weiser National Forest, May, 1923, *Lommasson 158* (FS); near Joseph, Idaho Co., May, 1939, *J. H. Christ 10205* (Herb. J. H. Christ). Oregon: Union County, 1879, *Cusick 727* (G, type); 20 miles south of Ukiah, Umatilla Co., June, 1916, *Eggleston 12715* (US); near Rhea Creek, Morrow Co., May, 1894, *Leiberg 59* (G, O, UC, US); near Prairie City, Grant Co., April, 1925, *Henderson 5062* (G, M, O, US); near Maupin, May, 1928, *Thompson 4079* (T, US); Enterprise-Joseph, Wallowa Co., May, 1923, *Sherwood 20* (W). Washington: near Spangle, Spokane Co., April, 1916, *Suksdorf 8512* (G, NY, UC, US, WSC), May, 1916, *Suksdorf 8647* (G, UC, US, WSC); near Rock Lake, Whitman Co., May, 1936, *Rollins & Constance 1098, 1101, 1104* (G, R, WSC); near Pine City, Whitman Co., May, 1936, *Rollins*

& Constance 1091 (G, NY, R, WSC), May, 1898, *Piper 2828 & 2829* (G, WSC); Cleman Mt., June, 1892, *Henderson 2388* (G, UW); Ellensburg, Kittitas Co., May, 1897, *Piper 2711* (G, WSC); Johnson's Canyon, Yakima region, July, 1883, *Brandegee 624* (G, UC); Grande Ronde River, Asotin Co., May, 1922, *St. John & Brown 4198* (WSC).

This species is very distinctive and is easily separated from other members of the genus. At one point (near Pine City, Washington) in its range, there is apparently some natural crossing with *Arabis sparsiflora*, var. *subvillosa*. Piper collected specimens in the area which exhibit several-branched trichomes, hirsute pedicels and broader basal leaves than are usually found in *A. Cusickii*. These specimens are intermediate between the latter species and *A. sparsiflora*, var. *subvillosa*. Since *A. Cusickii* shows no such variations toward var. *subvillosa* in other parts of its range and since the departures from the normal toward *A. sparsiflora*, var. *subvillosa* take place in an area where both species abound, it is logical to assume that some natural hybridization has occurred. The hybrids, if indeed they are hybrids, are much closer to *A. Cusickii* than to *A. sparsiflora*, var. *subvillosa* and are provisionally placed with the former species.

Plants from the Salmon River Basin of eastern Idaho are not quite typical, in that they have but one or two stems and lack the strongly developed caudex usually found in the species. Also, the pubescence is less conspicuous, but these plants are not otherwise distinctive and seemingly do not represent a separate variety.

(*To be continued*)

A hybrid Cornus from Cape Breton.—

× Cornus **acadiensis,** hybr. nov. (*C. alternifolia* × *C. stolonifera*) frutex adscendens, ramibus brunneo-purpureis valde divergentibus, medulla grisea; foliis oppositis pseudoverticillatis ovatis vel ellipticis breviter acuminatis, petiolis gracilibus 1–1.5 cm. longis; cymis 2.5–4 cm. diametro; fructibus lividis vel caeruleis.—Nova Scotia: thicket along cold brook at head of Baddeck Bay, Baddeck, Victoria County, August 30, 1920, *Fernald & Long*, no. 22,092 (distrib. as *A. Amomum*), type in Herb. Gray.

× *Cornus acadiensis* has the leaves crowded in subverticillate platforms as in *C. alternifolia* but opposite and with outline nearer that of *C. stolonifera*. Its horizontal branching suggests the former; the compact cyme and fleshy drupes suggest *C. stolonifera* but their color is that of *C. alternifolia*. So far as we yet know *C. Amomum* does not occur east of southwestern Maine;[1] and the eastern limit of *C. obliqua*, often confused with it, is in southeastern Maine or adjacent New Brunswick.

In Cape Breton both *Cornus alternifolia* and *C. stolonifera*, the probable parents of × *C. acadiensis*, are common.—M. L. Fernald.

[1] The citation in Gray's Man., ed. 7, of *C. Amomum* from Newfoundland was based on an old misidentification.

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H pl. 669

Carex Dutillyi: habit, × 1; inflorescences, × ½

Rhodora

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THE NEW ENGLAND BOTANICAL CLUB

Vol. 43. September, 1941. No. 513.

A NEW SPECIES OF CAREX AND SOME NOTES ON THIS GENUS IN ARCTIC CANADA

Hugh O'Neill and Maximilian Duman

This paper is based upon the study of the large collections of Carex made during eight consecutive summers in eastern and western Canada by Rev. Artheme Dutilly, O.M.I., as well as those made by the junior author in 1938 at various points from Churchill, Manitoba, to Winter Island in Fox Basin and in Northern Ungava, and our joint collection in 1939 on the coasts of Labrador, Hudson Strait and the eastern coast of Hudson Bay and James Bay. We also had the advantage of studying simultaneously Theodor Holm's large collection of Canadian and arctic Carices in this Herbarium. This includes numerous sheets of Carex collected by John and James Macoun, Cox, Low, J. J. O'Neill and others of the Canadian Geological Survey who sent their Carex specimens to Holm for determination.

While collecting at Churchill the junior author gathered specimens from a colony of Carex growing several hundred yards east of the town, and a few days later discovered a similar colony west of the Churchill River. These specimens, while belonging to the Section Divisae, are not referable to any species within that section. We are therefore describing the plant as:

Carex **Dutillyi** O'Neill and Duman, sp. nov. Tab. 669.

Rhizoma gracile, 1 mm. crassum, fuscum, squamis lineari-lanceolatis (10–20 mm. longis) imbricatis, in fibrillis dissolutis, vestitum. Culmi 3–18 cm. alti, apice 0.5–0.6 mm., basi 0.8–1.0 mm., crassi, stricti, distantes, obtusanguli, leves, foliis longiores

interdum breviores. Folia 5–10 in culmo, 2–12 cm. longa, 0.5 mm. lata, involuta, superne leviter scabriuscula; vaginae subarctae antice hyalinae; ligula brevis, 0.1 mm. alta. Spicae 2–4 (raro 1 vel 5), in capitulum subovatum vel lineari-oblongum congestae. Capitulum 5–15 mm. longum, 4–7 mm. latum; spica terminalis androgyna, floribus masculinis conspicuis, perigyniis 3–8. Spicae laterales maturae facile distinguuntur; floribus masculinis inconspicuis; perigyniis 1–6, squarrosis. Bracteae glumis similes, acutae mucronataeve. Glumae femininae late ovatae, 3.5 mm. longae, 2.5 mm. latae, apice obtusae vel acutae, castaneae, marginibus hyalinis, centris pallidis, perigyniis fere aequilongae, ea complectentes. Glumae masculinae similes attamen pallidiores angustioresque. Cladoprophyllum perigyniis simile, 3 mm. longum, 2.8 mm. latum, achenium suffultum. Antherae 1.8–2.3 mm. longae. Perigynia elliptica, 3–4.2 mm. longa, 1.5–1.8 mm. lata, subbiconvexa, fulva (pars exserta castanea), chartacea, utrinque 10–14-costata, haud alata, substipitata, basi spongiosa, in rostrum leve (0.5 mm. longum) abrupte contracta, antice fissum et emarginatum apice hyalinum. Achenia lenticularia, quadrato-ovalia, 1.8 mm. longa, 1.2 mm. lata, fulva, substipitata, subapiculata, laxe inclusa; stylus gracilis; achenio geniculatus; stigmata 2.

Rhizome slender, 1 mm. thick, brown, clothed with overlapping scales, the latter linear-lanceolate, 10–20 mm. long, more or less persisting as a fibrous coat. Culms 3–18 cm. tall, 0.5–0.6 mm. thick at apex, 0.8–1.0 mm. at base, erect, distant, obtusely angled, smooth, longer or sometimes shorter than the leaves. Leaves 5–10 on a culm, 2–12 cm. long (slightly longer in sterile tufts), 0.5 mm. wide, involute, slightly scabrellate toward the apex; sheaths rather close-fitting, hyaline ventrally; ligule a low arched ridge, 0.1 mm. high. Spikes 2–4 (rarely 1 or 5) aggregated in a solitary, irregularly ovoid to linear-oblong head, 5–12 mm. long, 4–7 mm. wide; terminal spike androgynous, the staminate portion conspicuous above the 3–8 perigynia; lateral spikes readily distinguishable at maturity, staminate portion inconspicuous, perigynia 1–6, conspicuously spreading when mature. Bracts resembling the glumes, acute to mucronate. Pistillate glumes broadly ovate, 3.5 mm. long, 2.5 mm. wide, obtuse to acute at the apex, chestnut-brown with lighter center and midrib, wide-hyaline margins, nearly as long as the perigynia and clasping them; staminate glumes similar but lighter colored and narrower. Cladoprophyllum well-developed at the base of the two lower spikes, 3 mm. long, 2.8 mm. wide, perigynium-like, usually containing a fully developed achene. Anthers 1.8–2.3 mm. long. Perigynia elliptic, 3–4.2 mm. long, 1.5–1.8 mm. wide, nearly biconvex, yellowish brown becoming chestnut brown on

exserted portion, chartaceous, 10–14 ribbed on each face, substipitate, the walls spongy-thickened at the base, slightly angled but not winged, abruptly narrowed into the smooth beak which is 0.5 mm. long, obliquely cleft and emarginate dorsally, its apex and overlapping margins of the orifice hyaline. Achenes lenticular, quadrate-oval, 1.8 mm. long, 1.2 mm. wide, yellowish-brown, short-stipitate, short-apiculate, loosely enclosed; style slender, jointed with achene; stigmas 2.

The systematic position of *C. Dutillyi* in Mackenzie's treatmeant of *Carex* in the North American Flora (**18:** 32) is in Section 7, *Divisae,* where it would appear in the key with *C. Eleocharis* Bailey. In Kükenthal's treatment of *Carex* in Das Pflanzenreich the species should be inserted under Section *Divisae* (**4²⁰:** 119) where it would appear with *C. stenophylla* Wahlenb., which is the Eurasian counterpart of *C. Eleocharis.*

C. Dutillyi may be distinguished from the above species, and from *C. maritima* Gunn. by the following keys:

Leaves 5–10 to a culm; head irregularly ovoid to linear-oblong, 5–12 mm. long, 4–7 mm. thick; spikes 1–4 (5), distinguishable at maturity; cladoprophyllum perigynium-like, often containing a mature achene; perigynia biconvex, elliptic, 3–4.2 mm. long, sessile; beak smooth, entire; achenes quadrate-oval, 1.8 mm. long, 1.3 mm. wide, substipitate, loosely enveloped .... *C. Dutillyi.*

Leaves 1–4 to a culm; head ovoid to oblong, 5–20 mm. long, 5–12 mm. thick, spikes generally more than 5, not readily distinguishable; cladoprophyllum not perigynium-like, sterile; perigynium plano-convex, ovate-orbicular, 2.5–3 mm. long, substipitate; beak serrulate, bidentate; achenes orbicular-ovate, 1.7 mm. long, 1.5 mm. wide, sessile, closely enveloped .... *C. Eleocharis* (American plants).
C. stenophylla (European plants).

Culms erect, straight; spikes 1–5, distinguishable at maturity; head irregularly ovoid to linear-oblong; terminal spike with conspicuous staminate portion; bracts and glumes chestnut-brown with light center and definite midrib and hyaline margins; glumes wider than, and clasping, the perigynia; cladoprophyllum sheathing, perigynium-like and often containing a mature achene; perigynia ribbed ventrally, sessile, chartaceous, not inflated, spongy-thickened at base; achenes quadrate-oval .... *C. Dutillyi.*

Culms generally curved; spikes 4–12, nearly indistinguishable; head subglobose or short-ovoid; terminal spike with inconspicuous staminate portion; bracts and glumes thin, completely hyaline to uniformly dark chestnut throughout; glumes slightly narrower than, and not clasping, the perigynia; cladoprophyllum neither sheathing nor bearing an achene; perigynia smooth ventrally, long-stipitate, submembranaceous, slightly inflated, not spongy at base; achenes suborbicular .... *C. maritima* Gunn.

From the habitally similar *Carex Langeana* Fernald it is distinguished as follows:

Achenes maturing; cladoprophyllum perigynium-like, generally containing mature achenes; glumes castaneous with lighter center and wide hyaline margins; anthers 1.8–2.3 mm. long; leaves smooth, slightly scabrous toward the apex......*C. Dutillyi.*
Achenes not known to mature; cladoprophyllum scarcely developed, not bearing an achene; glumes "deep-ferruginous * * * with only a narrow pale border"; anthers 1 mm. long; leaves definitely spinulose-scabrous.......................*C. Langeana.*

The TYPE specimen (*Duman* 1506, West of Churchill River, Aug. 8, 1938, Churchill, Manitoba) is in the Langlois Herbarium, Catholic University of America. Isotypes will be sent to the Gray Herbarium, U. S. National Herbarium, California Academy of Science, St. Vincent College, etc. COTYPE—*Duman* 1358, East of Churchill, July 30, 1938; ISOTYPE *Dutilly* 6577, West of Churchill River, Aug. 8, 1938, Churchill, Manitoba.

STATUS OF CAREX SCIRPIFORMIS MACKENZIE AND EXTENSION OF ITS RANGE.—According to Mackenzie's descriptions of *C. scirpoidea* Michx. and *C. scirpiformis* Mackenzie (N. Am. Fl. **18:** 207), they differ as follows:

Rootstock not fibrillose; glumes with very narrow hyaline margins; perigynia "short whitish pubescent", 2.5–3 mm. long, 1 mm. wide..*C. scirpoidea.*
Rootstock fibrillose; glumes with broad white hyaline margins; perigynia "yellowish-brown or greenish-brown hirsute", 2.5–5 mm. long, 1.25 mm. wide..........................*C. scirpiformis.*

A study of several hundred specimens collected on the eastern and western shores of Hudson Bay and the Islands in the Bay show that these characters cannot be used to make any definite separation of these specimens. Frequently the specimens exhibit both wide hyaline margins and very narrow hyaline margins on culms from the same tuft, sometimes even on the same spike. This characteristic of the glumes is the best possible separation proposed by Mackenzie; the other characters mentioned are still more unsatisfactory as a means of separating these plants. The form with hyaline margins appears to be most common in Manitoba, especially at Churchill, and in Alberta. On account of the very numerous freely intergrading plants we feel that it is best to treat this plant as a somewhat localized race, having a range on both sides of Hudson Bay in addition to the range given by Mackenzie. We therefore propose the new combination

CAREX SCIRPOIDEA var. **scirpiformis** (Mackenzie) O'Neill & Duman, comb. nov. (*C. scirpiformis* Mackenzie, Bull. Torr. Club **35**: 270. 1908.)

We cite the following specimens as intermediate forms

C. SCIRPOIDEA approaching the var. SCIRPIFORMIS *Duman* 1019 (Churchill), 2424 (Sugluk). *Dutilly* 6004, 6841a (Wakeham Bay). *Dutilly, O'Neill & Duman* 87726 (Port Harrison), 87568 (Sleeper Islands), 7725 (Port Manvers), 7833 (Cape Mugford).

C. SCIRPOIDEA var. SCIRPIFORMIS approaching the typical form of the species—*Duman* 1038, 1466, 1072 (Churchill). *Dutilly, O'Neill & Duman* 97142 (Cape Jones), 87267 (Wakeham Bay), 87799 (Frazier Island).

STATUS OF CAREX DRUMMONDIANA DEWEY.—Some of the more robust, southern plants of *C. rupestris Bellardi* of our collection suggested the possibility that *C. Drummondiana* might enter our area, and prompted a study of the status of that plant. It was originally described by Dewey (Am. Jr. Sc. **29**: 251 1836), and reduced to the status of a variety by Bailey, Cat. N. Am. Car. 4 1884). Mackenzie (N. Am. Fl. **18**: 220) recognizes it as a valid species with a range in the Canadian Rockies and the high mountains of central Colorado. Kükenthal (Pflanzenreich **4**[20]: **86** 1909) places it in the synonymy of *C. rupestris* without comment.

The following table gives the characters generally used in separating these two species, for a number of specimens. (A typographical error in Mackenzie's key should be noted, viz. leaves 1–3 mm. wide, not 1.3 mm. p. 219.)

	Scales concealing perigynia	Spike mm. thick	Culm mm. thick	Leaves mm. wide
Clokey 3697 Colorado	(1)	3	0.4–0.6	1.5–2.0
Clokey 3319 Colorado	immature	3	0.6–0.8	1.5–3.0
Grøntved 198 Greenland	immature		0.6–0.8	1.5–3.0
Holm in 1886 Greenland	(2)	3	0.6–1.0	0.8–2.0
Jansen 8/7/36 Greenland	(2)	3.5	0.6–1.0	1.0–2.0
Kükenthal in 1900 Tyrol	yes	3	0.5–0.8	2
Montell in 1935 Lapland	yes	2	0.6–0.7	1.0–1.5

A study of about 80 other sheets of this species from Siberia, Scandinavia, Russia, Ural Mountains, Ellesmere Island, Hudson Bay Region, Alberta, Colorado, etc., shows that in specimens from all these localities the glumes may, or may not, conceal

the perigynia, the spike may be stout or slender, the perigynia may be separated or not, the leaf-blades may be wide or narrow. These observations lead us to accept without qualification Kükenthal's placement of *C. Drummondiana* in the synonymy of *C. rupestris Bellardi.*

The use by Kreczetowicz (Fl. U.R.S.S. **3:** 381 1935) of "Bellardi ex Allioni" calls attention to a part of Allioni's preface (Fl. Pedem. **1:** IV 1785) which evidently has often been overlooked, but which clearly bears out Kreczetowicz, namely, that Allioni "sequenti signo †" designates those species of which "alter auditor meus Cl. Ludovicus Bellardi" is the author. The following Carices are marked with the † and hence are to be credited to Bellardi: *C. rupestris, C. Bellardi* (incongruous as this may seem), *C. bipartita, C. nigra, C. bicolor* and *C. trigona.*

The Status of Carex physocarpa Presl and Carex miliaris Michx.—Mackenzie (N. Am. Fl. **18:** 445–450 1935) in section *Vesicariae* lists three species, *C. miliaris* Michx., *C. saxatilis* L., and *C. physocarpa* Presl, as having stigmas typically two in contrast to the rest of the section having stigmas typically three. The ranges given for these three species are respectively:

C. miliaris, Labrador, Newfoundland, Quebec and central Maine.
C. saxatilis, Greenland, Labrador and Arctic Eurasia.
C. physocarpa, Pribolof Island, Upper Yukon, Mackenzie, south to the mountains of Utah and Colorado, Hudson Bay.

Most authors hold views at variance with Mackenzie's treatment; in fact, all authors consistently disagree with each other in treating this group. Thus Kükenthal (Pflanzenreich **4**[20]**:** 719, 727–728 1909), while recognizing *C. miliaris* as a species, considers *C. saxatilis* as a subspecies of *C. vesicaria* L., and *C. physocarpa* as: *C. vesicaria* L. subsp. *saxatilis* "L." Kükenthal var. *physocarpa* (Presl) Kükenthal.

L. H. Bailey (Bot. Gaz. **9:** 119–120 1884) treats *C. saxatilis* as a species of which *C. miliaris* is a variety, and in this he is followed by Fernald (Rhodora **3:** 50 1901). Later Bailey (Mem. Torr. Bot. Club **1:** 35–36 1889) accepted *C. miliaris* as a species distinct from *C. saxatilis* "with which it has no immediate affinity."

Polunin (Bot. Can. E. Arctic **1:** 135 1940) treats *C. miliaris*

as a variety of *C. saxatilis*, commenting that the latter is "a very complex and variable species which in the western parts 'runs into' phases of the next two." [evidently *C. miliaris* and *C. physocarpa*].

Hultén (Fl. Aleut. Isl. 119–120 1937), while recognizing *C. physocarpa* as a species, comments that it is closely related to *C. saxatilis.*

On one point, at least, all authors, including Drejer (Rev. Crit. 56 1841), Tuckerman (Enum. 13 1843), Lange (Fl. Dan. **48** pl. 2850 1871), Akiyama (Jr. Fac. Sc. **2**[1]**:** 226 1932), Hultén (l.c.), Ohwi (Mem. Coll. Sc. **11**[5]**:** 500 1936), Kreczetowicz (Fl. U.R.S.S. **3:** 448–449 1935), and Polunin (l.c.), [except Kükenthal (l.c. 727)], agree; viz. that *C. saxatilis* should be treated as a species rather than a subspecies.

From an examination of nearly a thousand specimens of this group and of *C. vesicaria* we agree with the concensus of opinion that the two stigmas of this group is a sufficiently sharp distinction between it and *C. vesicaria* with its three stigmas. Drejer (l.c.), Lange (l.c.), Ostenfeld (Fl. Arct. **1:** 95 1902), and Ostenfeld and Gröntved (Fl. Iceland and Faer. 35 1934) accept the specific rank of *C. saxatilis* [under the name of *C. pulla* Good. although Goodenough's name (1797) is antedated by *C. saxatilis* L. (1753)].

Th. Holm (Am. Jr. Sc. **10:** 271 1900) considers specimens from Kadiak, Alaska (*Walter Evans* 316 in Catholic University Herb.) as better referable to *C. physocarpa* "than to *C. compacta* R. Br. [*C. membranacea*], but neither this nor *C. physocarpa* is well understood, thus the identification is very uncertain."

C. ambusta Boott is considered a synonym of *C. physocarpa* by Kükenthal (l. c. 728), Mackenzie (l. c. 448) and Hultén (l. c. 119), although Bailey (l. c. 40) treats it as a distinct species. The type specimen from Sitka, Alaska, is in the Prescott Herbarium, Oxford, and is well illustrated in Boott's "Illustrations of the Genus Carex", 1858. Boott later on, in vol. 4, refers this species to *C. salina* Wahlenb., which view is reflected in Bailey's earlier publication (*C. salina* var. *ambusta* Bailey in Carex Cat. 1884). Commenting on *C. ambusta,* Bailey (l. c.) says, "This is a good species to be separated from *C. saxatilis,* its nearest ally, by * * * perigynium nearly lanceolate, gradually

long-pointed and spreading, possessing none of that shiny, papery and inflated appearance so characteristic of most of the *Vesicariae;* scales much longer and acute or muticous; lower spike on a short but slender peduncle. Ungava Bay (Turner); British Columbia (Rothrock) to Alaska".

A reference to Boott's illustration clearly shows an ovate, short-pointed perigynium, with the lower spike on a very long peduncle. Boott's type-specimen, illustration and description correspond so closely to Presl's type-specimen and description that the view of Kükenthal, Mackenzie and Hultén seems hardly debatable. We have found it sufficiently difficult to segregate *C. physocarpa* and quite impossible to separate *C. ambusta* from *C. physocarpa.* Further, Turner's specimen from Ungava and Rothrock's from British Columbia are clearly *C. physocarpa.* Kükenthal (l. c. 728) cites Turner's specimen as *C. physocarpa.*

Mackenzie (l. c. 446) separates *C. physocarpa* from *C. saxatilis* by means of the following key:

Ligule longer than wide, or about as long as wide; basal sheaths reddened, breaking and becoming filamentose; style strongly bent downward against achene at maturity; achene broadly ovoid or obovoid........................*C. physocarpa* Presl.
Ligule very short; basal sheaths little or not at all reddened and not breaking and becoming filamentose; style flexuous; achene suborbicular....................................*C. saxatilis* L.

Taking these characters in the order given, we find first of all that the wording is rather ambiguous. "Ligule longer than wide" is illustrated in Mackenzie's North American Cariceae, pl. 511, as a very short ligule about 0.3 mm. long (according to scale), while the ligule figured on pl. 512 for *C. saxatilis* is 1 mm. long. From this it is evident that Mackenzie really means that the ligule in *C. physocarpa* is long in the sense that it is high-arching, while the ligule in *C. saxatilis* is short in that it is scarcely arching. Mackenzie refers to the plate of *C. saxatilis* in Fl. Dan. (pl. 2850) as excellent, and bases his treatment on that plate. While it is true that this drawing of *C. pulla* (*C. saxatilis*) is beautifully done, the ligule is the least accurate feature of the plate. Further, European specimens of *C. saxatilis* commonly show exactly the same ligule as is figured in Mackenzie's plate 511 for *C. physocarpa;* e. g. *Baenitz* 2680 (Norway) has ligules which

are just as high-arching (long) as those figured for *C. physocarpa* (pl. 511), or as any specimen of this species from the Canadian Rockies and Alaska. The drawing for *C. saxatilis* (pl. 512) was based on a specimen from Jemtland, Sweden (*DuRietz* July 30, 1911). In the Catholic University Herbarium there is a specimen collected by Beurling and Lagerheim, Aug. 1843, also from Jemtland, which agrees in all features with pl. 512 except that the ligule is high-arching. From this it is clear that the ligule is not only worse than useless as a separating character, but extremely misleading as well.

The second character used to separate these two entities is sheaths "not at all reddened" in *C. saxatilis.* Out of 28 sheets of this species from Greenland, Iceland, Faeroes and Scandinavia in the Catholic University Herbarium, six show considerable reddening of the sheaths, while M. P. Porsild's specimen from Disco Island (July 29, 1935) is red enough to use at a bull-fight. On the other hand, out of 40 specimens of *C. physocarpa* from the Rocky Mountains and Alaska 27 are not red, although Mackenzie's key calls for "basal sheaths reddened". These specimens were all determined as such by Holm, a number of them by Mackenzie, F. J. Hermann, J. W. Stacey, etc., and all were verified by the present authors.

Equally valueless as redness of sheaths is the property of breaking into filaments, since the European specimens show it as much or, better, as little as the specimens from the Rocky Mountains and Alaska.

The last differentiating characters mentioned are "style flexuous, achene suborbicular" in *C. saxatilis,* and "style strongly bent downward against achene at maturity, achene broadly ovoid or obovoid" for *C. physocarpa.* The following table shows how useless these characters are for separating the plants in question.

C. SAXATILIS L.

	Style	*Achene*
1. *Grøntved* 280. Greenland.	Looped downward, but not appressed.	Broadly pyriform 1.5 × 1.4 mm.
2. *Seidenfaden* 221 Greenland.	Looped downward and appressed.	Obovate 2.1 × 1.7 mm.
3. *Porsild* 7/29/35 Greenland.	Conspicuously looped downward and appressed.	Broadly obovate 1.8 × 1.5 mm.

	C. physocarpa Presl	
4. *Dawson* 13413 Yukon (Cited by Kükenthal as *C. physocarpa* l. c. 728.)	Erect, not looped.	Broadly pyriform 2.0 × 1.5 mm.
5. *Piper* 4832. Unalaska.	Conspicuously looped and appressed.	Broadly obovate 2.0 × 1.7 mm.
6. *Cox* 647 Colorado. (Det. by Hermann.)	With two rt. angles, not looped, not appressed.	Broadly pyriform 2.0 × 1.5 mm.
7. *Howell* 1698 Alaska.	Looped and appressed.	Obovate 2.1 × 1.6 mm.

A few other differences between these two plants, as given by Mackenzie in the text, should be noted. The styles of *C. physocarpa* and *C. miliaris* are described as "blackish"; in *C. saxatilis* they are described as "whitish." As a matter of fact, the styles are equally very dark in all three plants. In the young stage the stigmas of all three plants have a white, somewhat scurfy coat, most pronounced in *C. physocarpa,* and not in *C. saxatilis,* as stated by Mackenzie. In old specimens of all three the white scurf is shed, and all are equally dark.

The width of the spikes as given by Mackenzie is 6–9 mm. for *C. saxatilis,* and 6–12 mm. for *C. physocarpa.* In all material examined in the Catholic University Herbarium the spikes of *C. saxatilis* were 4–5 mm. wide, and those of *C. physocarpa* were 6–10 mm. wide. (Kükenthal gives 6–12 mm. wide for this latter species.)

Kükenthal (l. c.) also gives certain distinguishing characters for *C. saxatilis* and *C. physocarpa* which may be summed up in the following key:

Staminate spike subsolitary, subclavate-cylindric; upper pistillate spike ovate and sessile, lower pistillate spike oblong-ovate and short-peduncled; perigynia 3–3.5 mm. long.....*C. saxatilis* L.
Staminate spikes two, cylindric; upper pistillate spike short-peduncled, erect, lower pistillate spike long-peduncled and nodding, both of them oblong-cylindric; perigynia 4 mm. long..*C. physocarpa* Presl.

Taking these characters in the order given, out of 91 plants of *C. saxatilis* from Greenland, Iceland, Faeroes and Scandinavia the staminate spikes were solitary in 85 and twinned in 6. On the 80 plants of *C. physocarpa* from the Rocky Mountains and Alaska the staminate spikes were solitary in 54 and twinned in 26. These figures show that two staminate spikes to a culm is

more common in *C. physocarpa* than in *C. saxatilis,* but that it has little diagnostic value. Further, the tendency of the staminate spike to be subclavate is common in *C. saxatilis* and relatively rare in *C. physocarpa,* but this is likewise only a prevailing tendency, not a decisive means of distinguishing these plants.

The next character, "upper pistillate spike sessile and ovate", seems to hold in nearly all specimens of *C. saxatilis* examined, while the "lower pistillate spike short-peduncled" is shown by 95% of the specimens of *C. saxatilis* examined. On the other hand, in nearly all the specimens of *C. physocarpa* where there are two pistillate spikes, the lower is conspicuously very long-peduncled, i. e. with a peduncle 1–3 times as long as the spike, while the upper pistillate spike is very rarely sessile, but usually short- to long-peduncled. In specimens of both *C. saxatilis* and *C. physocarpa* where the pistillate spike is solitary, the peduncle may be long or short.

Measurements ot the perigynia made on specimens in the Catholic University Herbarium indicate that they should be amended to read: *C. saxatilis* 3–4 mm. long; *C. physocarpa* 4–5 mm. long, as stated by Mackenzie (l. c.).

The summing up of the differences between typical plants of these two entities results in the following key:

Pistillate spikes 4–5(6) mm. wide, the upper ovate and subsessile, the lower spike oblong, short-peduncled, rarely long-peduncled (if the spike is solitary it may be long or short); perigynium 3–4 mm. long; staminate spike subclavate-linear, rarely linear..*C. saxatilis* L.

Pistillate spike 6–10 mm. wide, oblong, the upper short-peduncled (very rarely sessile), the lower long-peduncled, i. e. the peduncle ½ to 3 times the length of the spike (if the pistillate spike is solitary it may be either long or short); perigynium 4–5 mm. long; staminate spike linear, rarely subclavate....................................*C. physocarpa* Presl.

In the preceeding discussion only plants from two separate ranges have been cited. The wealth of material recently collected by Père Dutilly and the authors in the Hudson Bay region, a region intermediate betwen the two ranges, now remains to be discussed. This material is intermediate between *C. saxatilis* and *C. physocarpa* as shown by the size of the perigynia, the width of the pistillate spikes, the length of the peduncles, the shape of the staminate spike, and the general aspect of the whole

plant. Very similar forms occur on the peaks of Colorado where they are always called *C. physocarpa.* On the other hand these plants are closely matched by material from Greenland where they are always called *C. saxatilis.* In fact, if the plants from Scandinavia, Faeroes, Iceland, Greenland, Hudson Bay Region, Rocky Mountains, Pacific Coast and Alaska are arranged in the order named, a series of insensibly intergrading forms results. A dividing line drawn anywhere in this series is just as good, or just as bad, as a line drawn anywhere else. Accordingly, we follow Kükenthal (l. c.) in treating *C. physocarpa* as a variety of *C. saxatilis* (which, however, he considered a subspecies). The earliest available name seems to be *Carex saxatilis* var. *major* Olney in S. Wats. Bot. King's Expl. 370 1871. This publication is the "U. S. Geological Exploration of the 40th Parallel; Clarence King, Geologist in Charge; Vol. V Botany, by Sereno Watson, 1871." There seems to be no indication in the original description that it is Olney's, but Watson in his "List of Plants Collected in Nevada and Utah 1867–1869" (No. 1248) which is part of the same series, and published in the same year, credits the plant to Olney.

If a dividing line must be drawn between the species and the variety, it seems best to consider the material from the Hudson Bay region as an extreme form of the var. *major,* and to restrict *C. saxatilis* to arctic and subarctic Eurasia, Iceland and Greenland.

We find that we can segregate, as such, the plants of New England and southern Canada by using the key given by Mackenzie (l. c.), but the following key enables us to separate *C. saxatilis* var. *miliaris* more surely from var. *major.*

Perigynia 2.5–3.5 mm. long, tightly investing the achene, unequally lenticular, the empty space above the achene small, less than ¼ the body of the perigynium; anthers 1.5–2.5 mm. long; leaves 1–2(3) mm. wide; staminate spike narrowly linear, 1–2 mm. wide; lower pistillate spikes sessile or short-peduncled, erect, 4–7 mm. wide; lowest bract 0.5–1.0 mm. wide.......................... *C. saxatilis* var. *miliaris* (Michx.) Bailey.

Perigynia 3.2–5 mm. long, more or less inflated, the empty space above the achene often ⅓ to ½ the body of the perigynium; anthers 2.5–3 mm. long; leaves 1.5–5 mm. wide; staminate spike linear to linear-subclavate, 2–4 mm. wide; lower pistillate spikes short- or long-peduncled, 6–10 mm. wide; lowest bract 1–2 mm. wide......... *C. saxatilis* var. *major* Olney.

However, in the Hudson Bay region numerous forms intergrade so closely between *C. saxatilis* var. *major* and var. *miliaris*, that we feel justified in also treating the latter as a variety, as do Fernald (Rhodora **3:** 50 1901) and Polunin (Bot. Can. E. Arct. **1:** 135 1940). In many cases, e. g. *Duman* 1413, 1392, 1238, 1307, all from Churchill, Manitoba, the plants are exactly intermediate between the two varieties.

As to the arctic distribution in North America of these two varieties, we would limit *C. saxatilis* var. *miliaris* to the subarctic area of Quebec and Labrador, and *C. saxatilis* var. *major*, while becoming more typical as it approaches Colorado and the Rocky Mountains, is found both in the eastern and western arctic and subarctic. The line separating the varieties in Quebec and Labrador is not sharp.

Catholic University of America.

A MONOGRAPHIC STUDY OF ARABIS IN WESTERN NORTH AMERICA

Reed C. Rollins

(*Continued from page 411*)

30. A. Koehleri Howell. Perennial; caudex much-branched, woody, covered with peg-like leaf-bases; stems slender, simple, numerous, entirely glabrous to sparsely pubescent below, 5–30 (–40) cm. high; basal leaves numerous, linear to narrowly oblanceolate, acute, entire, stellate-pubescent, 1–2 cm. long, 2–4 mm. wide; cauline leaves sessile, lanceolate, auriculate, slightly clasping, entire, glabrous or nearly so, remote to overlapping, 1–2 cm. long; sepals oblong, often purplish, sparsely pubescent, 3.5–5 mm. long, 1.5–2 mm. wide, non-saccate; petals scarlet to deep purple, nearly oblong but with a short narrow claw, 7–10 mm. long, about 3 mm. wide; glandular tissue well developed, continuous beneath all stamens; pedicels ascending to divaricate, glabrous, 1–2 cm. long; siliques divaricately spreading, arcuate, glabrous, attenuate at apex, 5–8 cm. long, about 2 mm. wide; style short or absent; seeds orbicular, narrowly winged, about 1.5 mm. broad including wing, uniseriate.

Siliques sessile, only slightly curved; cauline leaves few, remote .... 30a. Var. *typica*.
Siliques shortly stipitate, strongly recurved; cauline leaves numerous, imbricated .... 30b. Var. *stipitata*.

30a. Var. **typica.** *A. Koehleri* Howell, Fl. Northw. Am. **1:** 44 (1897); Rollins in Res. Stud. State Coll. Wash. **4:** 21 (1936) in part. *A. arbuscula* Greene, Leaflets **2:** 77 (1910).—Southwestern Oregon: bluffs, Roseburg, Douglas Co., April 17, 1887, *T. Howell s. n.* (O, type; G, NY, T, isotypes), April & May, 1914, *Cusick 3950* (G, R, WSC), June, 1916, *Peck 6955* (WSC), April, 1934, *Thompson 10157* (NY, T, US); Mt. Nebo, near Roseburg, May, 1924, *Ingram 1498* (FS). Eight Dollar Mt., Josephine Co., June 18, 1904, *Piper 5056* (US, type; G, isotype of *A. arbuscula*).

30b. Var. **stipitata,** var. nov. Herba perennis; caulibus 1.5–4 dm. altis; foliis caulinis imbricatis auriculatis; siliquis arcuatis stipitatis 5–6 cm. longis, ca. 2 mm. latis.—Josephine County, Oregon: Camp Chicago Trail near Waldo, April 19, 1934, *Alice Eastwood & John T. Howell 1695* (G, type); Redwood Highway at north fork of Illinois River, April, 1934, *Eastwood & Howell 1432* (G); Kerby, May, 1922, *Sweetser 5748* (WSC); O'Brien, April, 1934, *Thompson 10275* (M, NY, T, US, W); Eight Dollar Mt., May, 1884, *T. Howell 34* (G).

The caudex is woody, strongly developed and highly branched in *A. Koehleri,* which gives it a distinctive appearance. The caudex-branches are covered with stiff peg-like leaf-bases making them resemble naked spruce-twigs. Ordinarily, the cauline leaves are few and remote, the basal leaves linear and the sessile siliques only slightly curved. However, some of the plants from Josephine County have numerous crowded cauline leaves, broader basal leaves and rather strongly recurved, shortly stipitate siliques. The latter I have called var. *stipitata.*

A. Koehleri is perhaps most closely related to *A. Breweri,* but the pubescence of the two species is wholly unlike. *A. Koehleri* has a moderately fine, truly stellate pubescence upon the basal and lower cauline leaves and is glabrous on the upper stem and pedicels. In *A. Breweri,* the leaves are covered with forked or dendritic trichomes and the stems and pedicels are hirsute with mostly simple spreading hairs.

31. A. microphylla Nuttall. Perennial; stems slender, several to numerous from a subterranean, branching caudex, few-flowered, simple or occasionally branched, glabrous above, somewhat hirsute with spreading simple or forked trichomes below or rarely glabrous, 1–5 (–7) dm. high; basal leaves linear to narrowly oblanceolate, entire, acute, densely pubescent with small dendritic trichomes, not pannose but appearing so to the naked eye, rarely almost glabrous, 5–20 mm. long; cauline leaves few, narrowly

lanceolate, auriculate, glabrous or the lower pubescent, 1–2 cm. long; sepals oblong, non-saccate, glabrous or rarely sparsely pubescent, green to purple-tinged, 2–3.5 mm. long; petals pale-rose to purplish, 4–6 mm. long, spatulate to cuneate; glandular tissue continuous beneath all stamens, weakly developed; pedicels slender, divaricate to more ascending, glabrous or rarely pubescent, 5–15 mm. long; siliques erect to obliquely spreading, straight to somewhat curved, narrow, blunt to slightly attenuate, glabrous, faintly nerved toward base, 2–6 cm. long, 1–1.5 mm. wide; style less than 1 mm. long or obsolete; seeds orbicular, small, narrowly winged, about 1 mm. broad, uniseriate (imperfectly biseriate in var. *saximontana*).

Key to the Varieties of A. microphylla

a. Siliques few on each stem, straight, erect to divaricate; plants usually less than 2 dm. high.....................*b*.
  b. Style absent or very short; pubescence fine.............*c*.
    c. Siliques erect, nerveless or only faintly nerved; caudex highly branched...........................31a. Var. *typica*.
    c. Siliques rigidly divaricate, nerved at base; caudex simple or branched only a few times; Wyoming and Idaho 31d. Var. *saximontana*.
  b. Style about 1 mm. long; pubescence coarser; plants of Washington..............................31c. Var. *Thompsonii*.
a. Siliques numerous on each stem, slightly curved, obliquely spreading; plants usually about 3 dm. or more high. 31b. Var. *Macounii*.

31a. Var. **typica.** *A. microphylla* Nuttall ex T. & G., Fl. N. Am. **1:** 82 (1838); Watson in Gray, Syn. Fl. N. Am. **1:** 167 (1895); Howell, Fl. Northw. Am. **1:** 41 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 359 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 243 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 38, fig. 11 (1936). *A. tenuicula* Greene, Leaflets **2:** 82 (1910).—Montana and Wyoming to Nevada and Washington. Map 16. Locality uncertain: Rocky Mountains, *Nuttall* (photo of type in Gray Herb.). Montana: Mt. Helena, Sept. 10, 1882, *F. W. Anderson* (NY). Wyoming: Yellowstone River, near Junction Butte, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson 5726* (G, M, NY, RM, US); Yellowstone Park, July, 1885, *Tweedy 554* (G, US); near Leckie, Sublette Co., June, 1901, *Merrill & Wilcox 634* (G, NY, US). Idaho: Lime Point, Nez Perce Co., May, 1926, *St. John 4374* (WSC); between Willow Cr. and Steep Cr., Idaho Co., May, 1936, *Rollins, Constance & Dillon 1106* (G, R, WSC); Granite Cr., Idaho Co., April, 1935, *Constance et al. 1014* (R, WSC); Gold Fork Lookout, Sawtooth Mts., Valley Co., July, 1937, *Thompson 13743* (G, R); near Patterson, Lemhi Co., July, 1916, *Macbride & Payson 3186* (G, M, RM, US); Bear Cr., be-

low Parker Mt., July, 1916, *Macbride & Payson 3304* (M, RM, US); near Martin, Blaine Co., July, 1916, *Macbride & Payson 3066* (G, RM, US); Ketchum, July, 1911, *Nelson & Macbride 1193* (G, RM). UTAH: Green Canyon, Cache Co., May, 1935, *B. & C. B. Maguire 15033* (G, R, UAC), May, 1932, *Burke 3449* (G, M, UAC); Logan Canyon, Cache Co., April, 1934, *B. & R. R. Maguire 15034* (R, UAC); Farmington Canyon, Wasatch Co., May, 1903, *Stokes s.n.* (NY); Big Cottonwood Canyon, Salt Lake Co., May, 1908, *Garrett 2237* (G); Parley's Canyon, April, 1908, *Garrett 2222* (G); Thistle, Utah Co., June, 1898, *Jones 6162* (M, US). NEVADA: Thomas Falls, 34 miles west of Elko, Eureka Co., June, 1937, *Breene 481* (NA); 6 miles west of canyon mouth, South Twin River, Toiyabe Mts., July, 1938, *Rollins & Chambers 2530* (G, R). OREGON: Jim Cr., Wallowa Co., June, 1897, *Sheldon 8303* (G, NY, UC, US); mouth of the Imnaha River, Wallowa Co., March, 1935, *Constance 1000* (R, WSC); mouth of Deep Cr., Wallowa Co., May, 1936, *Rollins, Constance & Dillon 1105* (G, R, WSC); crevices of cliffs, Union Co., May, 1883, *Cusick 1124* (US, type; G, isotype of *A. tenuicula*); basaltic cliffs near Union, June, 1909, *Cusick 3340* (R, US, WSC); above Alvord, Steens Mts., June, 1927, *Henderson 8409* (O); head of Willow Cr., Steens Peak, June, 1936, *Peck 19047* (R); Canyon City, Grant Co., July, 1921, *Peck 10164* (W); Rowena, Wasco Co., April, 1902, *Sheldon S. 10168* (G, O, NY, US, WSC); Mitchell Point, Hood River Co., April, 1920, *Suksdorf 2202* (WSC). WASHINGTON: east of Bishop, Whitman Co., May, 1936, *Rollins & Constance 1090* (G, R, WSC); Table Rock, Columbia Co., July, 1935, *Constance et al. 1274* (R, WSC); Williams Ridge, Columbia Co., July, 1913, *Darlington 123* (WSC); Lime Point, Asotin Co., April, 1928, *St. John 9292 & 9293* (WSC); Angell's Pass, Okanogan Co., July, 1931, *Fiker 260* (T); near Entiat, Chelan Co., April, 1931, *Thompson 6377* (G, OS, T, UW); base of Three Brothers Peak, Chelan Co., June, 1934, *Thompson 10530* (G, NY, RM, T, UW); Bingen, Klickitat Co., April 28, 1881, *Suksdorf 11695* (WSC), March, 1886, *Suksdorf 14* (G, R, WSC); White Salmon, March, 1886, *Suksdorf s. n.* (G); Prindle, Skamania Co., May, 1924, *Suksdorf 11695* (WSC).

31b. Var. **Macounii** (Watson), comb. nov. Stems numerous, 2.5–5 (–7) dm. high; basal leaves denticulate to entire; pedicels obliquely spreading, slender; siliques numerous on each stem, slightly curved to arcuate, widely spreading.—*A. Macounii* Watson in Proc. Am. Acad. **26:** 124 (1891) and in Gray, Syn. Fl. N. Am. **1:** 163 (1895); Rydb., Fl. Rky. Mts. 360 (1918). *A. densicaulis* A. Nelson in Bot. Gaz. **30:** 190 (1900); Rydb., Fl. Rky. Mts. 362 (1918).—Montana to Utah, Idaho and British

Columbia. MAP 16. MONTANA: without locality, *F. Tweedy* (US). WYOMING: Undine Falls, Yellowstone Park, July, 1899, *A. & E. Nelson 5680*[1] (RM, TYPE; G, isotype of *A. densicaulis*); 5 miles west of Beartooth Lake, Beartooth Mts., Park Co., July, 1939, *Rollins & Muñoz 2857* (G, R); east of Afton, Lincoln Co., July, 1923, *Payson & Armstrong 3370* (RM). IDAHO: upper Priest River, June, 1925, *Epling 7255* in part (UCLA); Rapid River, Custer Co., Aug., 1916, *Macbride & Payson 3608* (G, M, NY, RM, UC, US); Wild Horse Creek, Custer Co., July, 1939, *Davis 1205* (R); near Stanley Lake, July, 1937, *Thompson 14034* (G). UTAH: Mill Creek Canyon, Salt Lake Co., June, 1905, *Garrett 1201* (G, NY, RM); Fort Douglas, July, 1918, *J. F. Brenkle s.n.* (G). BRITISH COLUMBIA: Revelstoke, May 13, 1890, *John Macoun s.n.* (G, TYPE; M, US, isotypes).

31c. Var. **Thompsonii,** var. nov. Herba multicaulis; caulibus erectis ca. 1 dm. altis; siliquis acuminatis; stylis ca. 1 mm. longis.—WASHINGTON: alpine meadows of Table Mt., Kittitas Co., July 3, 1933, *J. W. Thompson 9266* (G, TYPE; NY, T, US, isotypes).

31d. Var. **saximontana,** var. nov. Herba paucicaulis; pilis minutis ramosis; caulibus 1–2 dm. altis; siliquis divaricatis obtusis; seminibus biseriatis vel uniseriatis.—Wyoming and Idaho. MAP 16. WYOMING: granitic hillsides, Porcupine Creek, near Medicine Mt., Big Horn Mts., Big Horn Co., July 6, 1936, *L. O. & R. Williams 3264* (G, TYPE; R, isotype); Piney Mt., 25 miles west of Big Piney, *E. B. & L. B. Payson 2670* (RM). IDAHO: Challis Creek, Custer Co., July, 1916, *Macbride & Payson 3319* (G, RM); Railroad Ridge, Custer Co., July, 1938, *Davis 603* (R).

Arabis microphylla is not as variable as some species of the genus and is usually readily recognized, but there are occasional specimens which show tendencies toward other species. Some collections from the Wasatch Mountains of Utah, for example, often possess the broader basal leaves of *A. Lyallii* and, unless mature fruits are present, they are difficult to place. Another instance is that of the alpine *A. nubigena* of Macbride & Payson, which I formerly treated as a variety of *A. microphylla*. The study of more material has now led me to associate this entity with *A. Lyallii*, but in many respects it is intermediate between the two species.

The stems of *A. microphylla* are slender and may be long and flexuose or short and rather rigid, depending largely upon the habitat in which the plants are growing. Ordinarily the species

[1] This same number was cited as the type of *A. elegans*, see Bot. Gaz. 33: 190 & 193 (1900).

may be found in crevices of basaltic rocks or on steep slopes in the vicinity of basaltic outcrops. *A. microphylla* follows rather closely the old Columbia River drainage and whenever it is found outside this drainage-area, marked minor differences are usually found. Thus, var. *saximontana* is partly outside the Columbia River drainage and is not associated with basaltic rocks; and var. *Macounii* is not wholly within this area. *A. microphylla* occurs most frequently in the Upper Sonoran Life Zone but penetrates well into the Canadian Life Zone at various points in its range.

Var. *Macounii* culminates a tendency toward numerous, curved, almost obliquely spreading siliques which is evident in plants from scattered stations in the range of var. *typica*. It does not have a markedly distinct geographic area which is separate at all points from that of var. *typica* but, in spite of this, it is a fairly well-marked entity on morphological grounds alone. The type of *A. densicaulis* is very similar to that of var. *Macounii* and it is evident that they should be included in a single category. It is with some hesitation that the plants here named var. *saximontana* are associated with *A. microphylla*. There is some evidence indicating that they represent a separate species, but a more thorough knowledge of their biology is needed to prove the point. The distinctive characters are the simple caudex, divaricate siliques and elliptical, imperfectly biseriate seeds. Var. *Thompsonii* has a coarser pubescence upon the basal leaves than is found in var. *typica*, and the acuminate siliques have a definite style which approximates a millimeter in length. Otherwise, it is very much like typical *A. microphylla*.

32. A. **Fernaldiana,** sp. nov. (p. 361, fig. 3). Herba perennis caespitosa; caulibus erectis vel basi decumbentibus inferne pubescentibus superne glabris vel pubescentibus 1.5–4 dm. altis; foliis radicalibus canescentibus integris spathulatis vel oblanceolatis petiolatis 1–4 cm. longis, 2–5 mm. latis; caulinis sessilibus auriculatis oblongis vel lanceolatis acutis 1–2 cm. longis, 2–3 mm. latis; sepalis oblongis pubescentibus 3–6 mm. longis, 1–1.5 mm. latis; petalis roseis spathulatis vel cuneatis 10–14 (5–7) mm. longis, 2.5–4 (2–3) mm. latis; pedicellis divaricatis glabris vel pubescentibus 5–10 mm. longis; siliquis erectis acuminatis glabris substipitatis 4–6 cm. longis, 1.5–2 mm. latis; stylis ca. 1 mm. longis; seminibus oblongis anguste alatis vel exalatis uniseriatis.

Perennial, caespitose; pubescence of fine dendritic trichomes; stems several to numerous from a branching caudex, erect to somewhat decumbent at base, densely pubescent below with a mixture of very fine and large trichomes or the large ones absent, pubescent or glabrous above, 1.5–4 dm. high; basal leaves numerous, entire, often clustered in sterile soboles, spatulate to oblanceolate, narrowly petiolate, densely pubescent with minute trichomes, canescent, 1–4 cm. long, 2–5 mm. wide, petioles usually ciliate with long simple or forking trichomes; cauline leaves sessile, auriculate, oblong to lanceolate, acute, densely pubescent or the upper glabrous, 1–2 cm. long, 2–3 mm. wide; inflorescence racemose, greatly elongating in fruit; sepals oblong, scarious-margined, pubescent, 3–6 mm. long, 1–1.5 mm. wide; petals pink, spatulate to cuneate, not differentiated into blade and claw, 10–14 mm. long, 2.5–4 mm. wide (5–7 mm. long, 2–3 mm. wide in var. *stylosa*); glandular tissue poorly developed, nearly surrounding single stamens, merely subtending paired stamens; filaments of paired stamens free or very rarely united; pedicels divaricate, glabrous or pubescent, 5–10 mm. long; siliques erect, acuminate, glabrous, nerveless, 4–6 cm. long, 1.5–2 mm. wide, substipitate, straight or nearly so; style about 1 mm. long; seeds oblong, narrowly winged or wingless, uniseriate, cotyledons accumbent.

Petals 10–14 mm. long; upper stems and the pedicels glabrous; basal leaves 2–4 cm. long .... Var. *typica*.
Petals 5–7 mm. long; upper stems and the pedicels pubescent; basal leaves 1–2 cm. long .... Var. *stylosa*.

Var. **typica.** Nevada: among rocks and around sagebrush, eastern slope of Toiyabe Dome, Toiyabe Mts., Nye Co., July 13, 1938, *Rollins & Chambers 2520* (G, type; R, isotype); Sheep Camp Meadows, 1 mile north of Road Forks Pass, Delano Mts., eastern Elko Co., May, 1940, *Train 3706* (G, NA, R).

Var. **stylosa** (Watson), comb. nov. Perennial; stems 1–3 dm. high; basal leaves 1–2 cm. long, 2–3 mm. wide; pedicels pubescent; sepals pubescent; petals 5–7 mm. long.—*A. canescens*, var. *stylosa* Watson, Bot. Calif. **2:** 431 (1880).—Nevada: granitic soil near rocks, between Lamoille Creek and Verdi Peak, Ruby Mts., about 13 miles southeast of Lamoille, Elko Co., July, 1938, *Rollins & Chambers 2570* (G, R); Sherman Ridge, south end of Ruby Range, Aug., 1939, *Hitchcock & Martin 5642 & 5643* (G); E. Humboldt Mts., Aug., 1868, *Watson 70* (G, type; NY, isotype).

This species, named in honor of Professor M. L. Fernald, is nearest related to *Arabis Crandallii* and *A. microphylla*. From *A. Crandallii*, with which it agrees in pubescence, typical *A.*

Fernaldiana is distinguished by its much broader, substipitate, attenuate instead of sessile, blunt siliques; larger flowers, glabrous upper stems and pedicels, and conspicuous style. In *A. Crandallii* the sepals and petals are only about half the length of those in typical *A. Fernaldiana* and the styles are very short or obsolete. The flower-size and pubescence-distribution of *A. Fernaldiana*, var. *stylosa* are about the same as in *A. Crandallii*, but the siliques, seeds and general habit are in accord with *A. Fernaldiana*, var. *typica*.

A. Fernaldiana (both var. *typica* and var. *stylosa*) has a very fine hoary pubescence covering its basal leaves and the lower stems are appressed-pubescent with many-branched trichomes. In *A. microphylla*, the basal leaves are not hoary, the pubescence is coarser and the lower stems are hirsute with simple trichomes or rarely glabrous. The flowers are smaller and the pedicels longer in *A. microphylla* than in *A. Fernaldiana*. Unfortunately, *A. Fernaldiana*, var. *typica* is known from only two collections and var. *stylosa* from only a few. Obviously a larger series is necessary before the relationship of this species to others in the genus can be accurately established. The type of var. *typica* was collected from plants growing abundantly near the upper limit of sagebrush on the eastern slope of the Toiyabe Mountains of central Nevada. Var. *stylosa* has been found only in the Ruby Range and adjacent East Humboldt Range of the same state.

Two specimens were cited by Watson with his original diagnosis of var. *stylosa*, "Plumas County (Mrs. Austin), and East Humboldt Mountains, Nevada, Watson, n. 70". Mrs. Austin's specimen belongs to *A. Lemmoni*, hence I have designated Watson's plant as type of var. *stylosa*. Thus restricted, it is possible to keep Watson's name going, but I do not feel justified in making it the species-name.

33. A. Crandallii Robinson. Perennial; pubescence composed of minute dendritic trichomes; stems numerous from a branching, subterranean caudex, slender, erect to slightly decumbent at base, simple or rarely branched, densely pubescent or sparsely so above, 1.5–4 dm. high; basal leaves numerous, entire to obscurely dentate, oblanceolate to somewhat spatulate, usually acute, petiolate, densely pubescent, canescent, 1.5–3 cm. long, 2–4 mm. wide; cauline leaves sessile, entire, auriculate or

the auricles rarely almost obsolete, densely pubescent, canescent, oblong to lanceolate, 8–15 mm. long, 2–4 mm. wide; inflorescence racemose, elongating in fruit; sepals oblong, pubescent, scarious-margined, 3–4 mm. long, about 1.5 mm. wide, neither pair saccate; petals white to pinkish, nearly spatulate, not differentiated into blade and claw, 5–7 mm. long, 2–3 mm. wide; nectar-glands poorly developed, merely subtending all filaments; pedicels slender, erect or slightly spreading, pubescent, 5–10 mm. long; siliques erect, slender, constricted between seeds, glabrous, nerveless or faintly nerved below, obtuse, 3–6 cm. long, about 1 mm. wide; style very short or absent; seeds orbicular to slightly oblong, less than 1 mm. broad, wingless to very narrowly winged, uniseriate.—Bot. Gaz. **28:** 135 (1899); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 359 (1918). *A. stenoloba* Greene, Pl. Baker. **3:** 8 (1901).—Map 17. Colorado: Gore Canyon, Grand Co., *Osterhout 3502* (NY, RM); 3 miles north of Sargents, Gunnison Co., *Rollins 2084* (G, R); 5 miles east of Parlin, Gunnison Co., *Rollins 2091* (G, R); 6 miles east of Gunnison, *Rollins 2093* (G, R); 12 miles south of Iola, Gunnison Co., *Rollins 2019* (G, R); 1 mile east of Sapinero, *Rollins 2111* (G, R); below Sargents, Saguache Co., *Osterhout 6919* (M); Cimarron, May 18, 1898, *Crandall 6* (G, type; NY, isotype), June 6, 1901, *C. F. Baker 21* (ND, type; G, M, NY, RM, US, isotypes of *A. stenoloba*).

Arabis Crandallii is canescent with a very fine pubescence on the stem and foliage and is distinctive because of its very narrow, moniliform siliques. Its relatives are *A. Fernaldiana* and *A. Selbyi*. *A. Fernaldiana* is well isolated geographically, but the range of *A. Selbyi* is adjacent to that of *A. Crandallii* on the west and north. *A. Selbyi* differs from *A. Crandallii* in having broader, spreading instead of erect siliques, larger obovate to oblanceolate basal leaves and definitely winged, instead of wingless, seeds. Probably the nearest relative of *A. Crandallii* is *A. Fernaldiana,* but this relationship has been discussed under that species. *A. stenoloba* is in no way different from *A. Crandallii.* It was founded on plants collected from the type locality of *A. Crandallii* and may have been published without knowledge of the latter species which was described only two years earlier. *A. Crandallii* is very abundant on rocky hillsides and open sagebrush slopes in the Gunnison Basin of west central Colorado. It appears to be confined to the Transition Life Zone and is usually found in granitic soils. Osterhout's collection from

Grand County is from some distance north of the Gunnison Basin, but it is typical in every way. Doubtless intermediate stations will be found when the area is more thoroughly known botanically.

34. A. **Gunnisoniana,** sp. nov. (page 390, fig. 3). Herba perennis caespitosa multicaulis; caulibus tenuibus simplicibus inferne pubescentibus superne glabratis 1–2 dm. altis; foliis radicalibus lineari-oblanceolatis acutis integris vel sparse dentatis pubescentibus 1–2 cm. longis, 2–4 mm. latis; foliis caulinis remotis oblongis acutis 5–8 mm. longis, ca. 2 mm. latis; sepalis pubescentibus oblongis 2–3 mm. longis, ca. 1 mm. latis; petalis roseis spathulatis 4–6 mm. longis, ca. 2 mm. latis; pedicellis gracilibus divaricatis pubescentibus vel glabris 5–8 mm. longis; siliquis glabris patentibus acutis inferne 1-nervatis 2.5–4 cm. longis, 1–1.5 mm. latis; stigmatibus sessilibus; seminibus orbicularibus alatis ca. 1 mm. latis uniseriatis.

Caespitose perennial; stems slender, numerous from a closely branching or simple caudex, densely pubescent below, glabrate above, simple, 1–2 dm. high; basal leaves numerous, linear-oblanceolate, acute, entire or rarely few-toothed 1–2 cm. long, 2–4 mm. wide, densely pubescent with medium-sized dendritic trichomes; cauline leaves few, remote, pubescent or the upper glabrate, oblong, acute, 5–8 mm. long, about 2 mm. wide, auriculate but the auricle small; sepals oblong, 2–3 mm. long, about 1 mm. wide; petals spatulate, pink to purplish, 4–6 mm. long, about 2 mm. wide; glandular tissue weakly developed, in a continuous mold under all stamens; pedicels widely spreading at right angles to rachis, straight to slightly curved downward, pubescent or rarely completely glabrous, slender, 5–8 mm. long; siliques glabrous, spreading at right angles to stem or slightly descending, straight to slightly curved, acute, nerved nearly to the middle, 2.5–4 cm. long, 1–1.5 mm. wide; stigma sessile; seeds orbicular, narrowly winged, about 1 mm. broad, uniseriate.—Colorado: Gunnison Co.: barren rocky knoll near Saguache Creek, 6 miles east of Gunnison, May 21, 1938, *Rollins 2090* (G, type; R, isotype); 4 miles east of Gunnison, May, 1938, *Rollins 2096* (G, R); 4 miles south of Tomichi Creek, about 10 miles southeast of Gunnison, Sept., 1937, *Rollins 2014* (G, R); 1 mile east of Sapinero, May, 1938, *Rollins 2114* (G).

While botanizing in the Gunnison Basin in the fall season of 1937, I discovered the basal leaves and old stems of an *Arabis* which was unfamiliar to me. Returning to the same locality the following spring, I found abundant material of the plant described above. *A. Gunnisoniana* is probably most closely

Fig. 1. A. Crandallii drawn from *Rollins 2091;* Fig. 2. A. lignifera drawn from *Rollins 2274.* Both figures about one-half natural size.

related to *A. Selbyi,* from which it differs in its smaller stature, smaller leaves, more numerous slender stems and narrower siliques. In habit our plant more closely resembles *A. demissa.* However, the pubescence and seeds of *A. demissa* and *A. Gunnisoniana* are entirely different. The species is named for J. W. Gunnison whose name designates the area in which it is abundant.

35. A. Selbyi Rydberg. Perennial; stems several to numerous from a simple or usually much branched caudex, usually branched above, erect or ascending, often decumbent at base, slender to fairly stout, pubescent below with dendritic or rarely forked trichomes, usually glabrous above, 2.5–5 dm. high; basal leaves numerous, oblanceolate to broadly spatulate, obtuse to nearly acute, entire or dentate, densely to sparsely pubescent with fine dendritic trichomes, grayish, 3–7 cm. long, 6–20 mm. wide; cauline leaves few, sessile, remote, linear-oblong to lanceolate, entire, auriculate, 2–5 mm. wide, 1–3 (–4) cm. long, lower pubescent, upper glabrous; sepals oblong, non-saccate, 3–4 mm. long, 1.5–2 mm. wide, pubescent; petals pink, spatulate to narrower, 6–8 mm. long, 1.5–2.5 mm. wide; glandular tissue poorly developed, continuous beneath all stamens; fruiting pedicels divaricately ascending or spreading at right angles to rachis, glabrous to sparsely pubescent, straight or nearly so, 5–12 mm. long; siliques slightly curved to straight, rarely nearly arcuate, divaricately ascending to spreading at right angles, glabrous, 3–6 cm. long, 1.5–2 mm. wide; valves faintly nerved at base to nerveless, often somewhat constricted between seeds; stigma sessile; seeds orbicular, narrowly winged, 1–1.5 mm. broad, uniseriate.—Bull. Torr. Bot. Club **31:** 557 (1904); Coulter & Nelson, New Man. Rky. Mts. 229 (1909); Rydberg, Fl. Rky. Mts. 361 (1918).—Western Colorado to Utah and northwestern New Mexico. Map 15. Colorado: 5 miles west of Walden, Jackson Co., Aug., 1937, *Beetle 2350* (R)?, only basal leaves and old stalks present; State Bridge, Eagle Co., May, 1910, *Osterhout 4215* (NY); Glenwood Springs, Garfield Co., June, 1902, *Osterhout 2576* (RM); 10 miles north of Mesa, Mesa Co., May, 1938, *Rollins 2191* (G, R); 8 miles west of Grand Junction, Mesa Co., May, 1938, *Rollins 2160 & 2170* (G, R); Grand Junction, June, 1915, *Macbride & Payson 714* (RM); tributary of Little Dolores River, 7 miles west of Glade Park, Mesa Co., Aug., 1937, *Rollins 1898* (R); 1 mile south of Gateway, Mesa Co., Aug., 1937, *Rollins 1910* (R); Paonia, Delta Co., May, 1911, *Osterhout 4513* (NY); 6 miles east of Montrose, Montrose Co., May, 1938, *Rollins 2122* (G, R); near Bostwick Park, Montrose Co., Aug., 1937, *Rollins 1984* (R); west of Ouray, Ouray Co., Sept. 9, 1901, *Underwood*

& Selby 207 (NY, TYPE); 10 miles northeast of Ridgeway, Ouray Co., Sept., 1937, *Rollins s.n.* (R). NEW MEXICO: Aztec, May, 1899, *Baker 343* (G). UTAH: 10 miles north of Vernal, Uintah Co., June, 1937, *Rollins 1753a* (DS, G); La Sal Mts., June, 1914, *M. E. Jones s.n.* (P); Red Canyon, near Bryce Canyon, Garfield Co., June, 1933, *Eastwood & Howell 667* (G).

The type of *A. Selbyi* is a slightly aberrant specimen when compared with plants from the type-locality placed in this species. The stems of the type are unusually elongated, as is the infructescence, and the pedicels diverge from the rachis at right angles, instead of being divaricately ascending as is usually the case. These peculiarities may be due to the fact that the type is a post-season plant, collected in September, instead of May or June, or perhaps it came from an unusual habitat. In August and September of 1937 and again in late May, 1938, I searched the general area where the type of *A. Selbyi* was collected, but no plants which exactly duplicate it were found. In the fall of 1937 basal leaves and old fruiting stalks were found at several stations, but these are like the plants collected in the spring of the following year. Further exploration of western Colorado may show that the type of *A. Selbyi* really represents a natural entity. If such is proved to be the case, then all the collections cited above, except the type, should be placed in a separate variety.

A. Selbyi is very closely related to *A. lignifera*. The differences between the two are pointed out in a discussion under the latter species. Obviously, the entire range of *A. Selbyi* is not known, and one cannot be certain that these two closely related plants will be kept as separate species if an intergrading series of forms is discovered. At present it seems best to treat them as distinct species.

36. A. LIGNIFERA A. Nelson. Perennial; stems one or usually few from a simple or branched caudex, erect, simple or usually branched above, densely pubescent below with appressed minute stellate trichomes, glabrous above, 2–5 dm. high; basal leaves linear-oblanceolate, acute to obtuse, entire, densely pubescent with minute dendritic trichomes, petiolate, 2–5 cm. long, 3–8 mm. wide; cauline leaves oblong, auriculate, entire, remote to subremote, 1–3 cm. long, 2–5 mm. wide, lower densely pubescent, upper sparsely pubescent to glabrous; inflorescence loosely racemose; sepals oblong, pubescent, purplish, 3–4.5 mm. long,

about 1.5 mm. wide, non-saccate; petals pink to purplish, spatulate to lingulate, 5–8 mm. long, 1.5–2 mm. wide; glandular tissue weakly developed, continuous beneath all stamens; fruiting pedicels sparsely pubescent to glabrous, arched downward, 5–12 mm. long; fruiting raceme lax; siliques laxly pendulous, not crowded, curved inward or rarely almost straight, glabrous or very rarely sparsely pubescent, 3–6 cm. long, 1.5–2 mm. wide, valves one-nerved to the middle or above; style very short or obsolete; seeds orbicular to slightly oblong, narrowly winged, 1–1.2 mm. broad, uniseriate to imperfectly biseriate, cotyledons accumbent.—Bull. Torr. Bot. Club **24:** 123 (1899); Coulter & Nelson, New Man. Bot. Rky. Mts. 229 (1909); Rydberg, Fl. Rky. Mts. 362 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 245 (1925).—Wyoming and Idaho to Arizona and Nevada. Map 2. Wyoming: 20 miles north of Baggs, Carbon Co., May, 1938, *Rollins 2211* (G, R); Green River, Sweetwater Co., June, 1898, *Nelson 4711* (RM, type; G, M, isotypes); 2 miles southeast of Green River, June, 1938, *Rollins 2246* (G, R); rocky hillside, near Lyman, Uinta Co., June, 1937, *Rollins 1614* (DS, G, R), June, 1938, *Rollins 2308* (G, R); 3 miles south of Lonetree, June, 1938, *Rollins 2304* (G, R); Flat Iron Butte, west of Cumberland, Lincoln Co., June, 1938, *Rollins 2359* (G, R). Colorado: Naturita, Montrose Co., April, 1914, *Payson 231* in part (G, M); 10 miles south of Montrose, Montrose Co., May, 1938, *Rollins 2129* (G, R); near Meeker, Rio Blanco Co., May, 1938, *Rollins 2222* (G, R); Disappointment Ranger Station, Dolores Co., May, 1914, *Wilson 711* (FS). Nevada: 7 miles northwest of Ragsdale Springs, White Pine Co., May, 1937, *Moore & Franklin 165* (R); 15 miles west of McGill, White Pine Co., May, 1937, *Moore & Franklin 229* (R); near South Twin Creek, eastern base of Toiyabe Dome, Nye Co., July, 1938, *Rollins & Chambers 2519* (G); 20 miles east of Battle Mt., June, 1933, *Eastwood & Howell 178* (G); Empire City, June, 1882, *Jones 3763* (P). Idaho: Beaver Canyon, June, 1895, *Shear 3064* (M); Shoupe, Lemhi Co., June, 1938, *Davis 417* (UIP); Big Creek, Butte Co., May, 1938, *Davis 182* (UIP). Utah: Gold Hill, Tooele Co., June, 1917, *M. E. Jones s.n.* (P); Deep Creek, Tooele Co., June, 1891, *M. E. Jones s.n.* (P); Clifton, Tooele Co., May, 1917, *M. E. Jones s.n.* (P); Alta, Salt Lake Co., July, 1910, *M. E. Jones s.n.* (P); Stansbury Island, Great Salt Lake, June, 1869, *Watson 76* (G); 15 miles southeast of Manila, Daggett Co., June, 1938, *Rollins 2274* (G, R); 10 miles north of Vernal, Uintah Co., June, 1937, *Rollins 1753* (G, R); Mammoth, Juab Co., May, 1910, *M. E. Jones s.n.* (P); Scofield, Carbon Co., June, 1904, *M. E. Jones s.n.* (P); Cedar City, Iron Co., May, 1894, *Jones 5204ad* (P). Arizona: 12 miles east of

Keams Canyon, Navajo Co., June, 1937, *Peebles & Smith 13438* (G, Sac).

Arabis lignifera is closely related to *A. Selbyi* and *A. Holboellii*, var. *retrofracta*. From the latter, it is distinguished by having loosely pendulous and curved, instead of strictly reflexed, straight siliques. Also, *A. lignifera* has smaller, more remote cauline leaves and smaller flowers than *A. Holboellii*, var. *retrofracta*. In general appearance, *A. lignifera* resembles *A. Selbyi* more than any other, but the two species differ in a number of technical points and apparently occupy separate geographical areas. The pedicels and siliques are divaricate to ascending and nearly straight in *A. Selbyi*, whereas in *A. lignifera* the pedicels arch downward with the pendulous siliques curved inward. The basal leaves of *A. Selbyi* are broadly oblanceolate to obovate and often repand or dentate, while in *A. lignifera* they are linear-oblanceolate and entire. The valves of the siliques in *A. lignifera* are strongly nerved to the middle or above, but in *A. Selbyi* the valves are plain or very faintly nerved at the extreme base. *A. lignifera* occurs in the upper Sonoran Life Zone and is usually associated with sagebrush, juniper or similar desert plants.

37. A. Holboellii Hornem. Biennial or perennial; stems one to several from a simple or branching caudex, simple or branched above, erect, pubescent throughout with appressed or spreading trichomes to glabrous above, 1–9 dm. high; basal leaves linear-oblanceolate to broadly spatulate, entire to somewhat dentate, densely pubescent with fine to coarse dendritic trichomes, often pannose, acute to obtuse, 1–5 cm. long, 1.5–6 (–8) mm. broad; cauline leaves auriculate and clasping to non-auriculate, with a narrowed base, entire, oblong to lanceolate, 1–4 cm. long, 1.5–6 mm. wide, lower densely pubescent, upper pubescent to glabrous; inflorescence loosely racemose; sepals oblong, scarious-margined, pubescent or glabrous, 2–4 (–5) mm. long, 1–2 mm. wide; petals spatulate with a narrow claw, purplish pink to whitish, (5–) 6–10 mm. long, 2–3.5 mm. wide; fruiting pedicels straight to somewhat curved, often geniculate, strictly reflexed to loosely descending, pubescent or glabrous, slender, 6–16 mm. long; siliques glabrous (sometimes pubescent in var. *retrofracta*), straight to slightly curved, strictly reflexed to loosely pendulous, nerved below or to slightly above middle, obtuse to acute, 3–7 cm. long, 1–2.5 mm. wide; seeds orbicular, narrowly winged all around, about 1 mm. broad, uniseriate or imperfectly biseriate.

Key to the Varieties of A. Holboellii

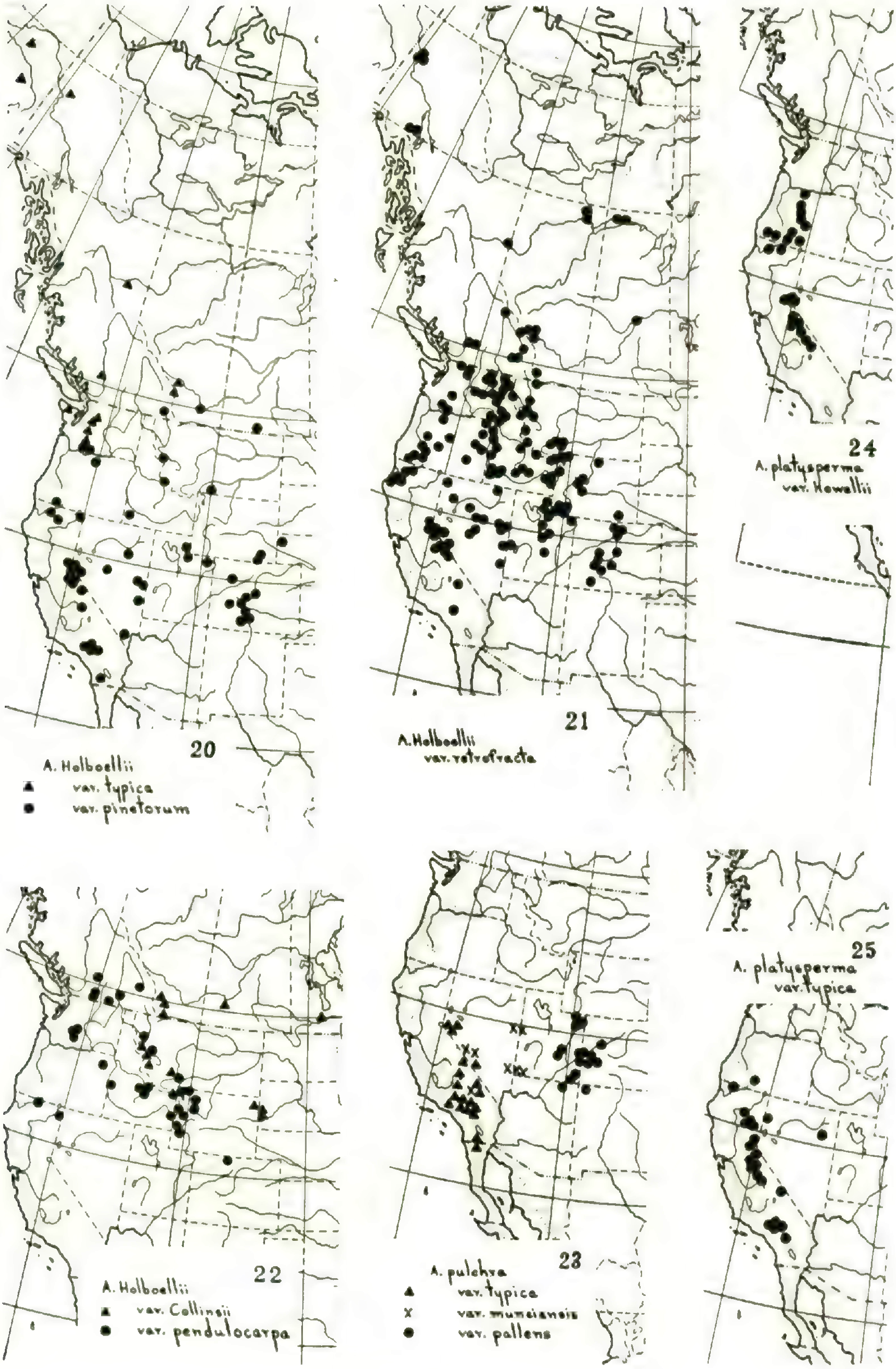
a. Cauline leaves auriculate; plants usually more than 2 dm. high; basal leaves mostly more than 3 mm. broad. . . . b.
  b. Pedicels geniculate near base, usually straight or at least not uniformly curved; siliques strictly reflexed to somewhat spreading, but not loosely pendulous, straight or nearly so; pubescence of basal leaves fine. . . . .*c*.
    c. Lower stem hirsutulous with large spreading hairs; petals 5–7 mm. long. . . . . .37c. var. *Collinsii*.
    c. Lower stem appressed-pubescent with small or minute hairs; petals 7–10 mm. long. . . . .*d*.
      d. Cauline leaves usually flat, upper glabrous; siliques 2–2.5 mm. wide; mature basal leaves evenly pubescent with spaced trichomes. . . . . .37a. var. *typica*.
      d. Cauline leaves usually revolute, upper finely pubescent; siliques 1–2 mm. wide; basal leaves densely pubescent, very often pannose. . . . .37b. var. *retrofracta*.
  b. Pedicels gently curved downward; pods pendulous, usually somewhat curved inward; pubescence of basal leaves coarse. . . . . .37e. var. *pinetorum*.
a. Cauline leaves lacking auricles; plants usually less than 2 dm. high; basal leaves less than 3 mm. broad. .37d. var. *pendulocarpa*.

37a. Var. **typica.** *A. Holboellii* Hornem., Fl. Dan. **11:** 5, t. 1879 (1827); Lange, Consp. Fl. Groenl. 49 (1880); Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895) in part; Henry, Fl. So. Brit. Columb. 149 (1918) in part; Rollins in Res. Stud. State Coll. Wash. **4:** 27 (1936); Hopkins in Rhodora **39:** 170 (1937) in large part. *Erysimum Holboellii* (Hornem.) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891), as "Hollboellii". *A. holboellii patula* sensu Piper in Contrib. U. S. Nat. Herb. (Fl. Washington) **11:** 293 (1906). *A. retrofracta* sensu G. N. Jones in Univ. Wash. Pub. Biol. **7:** 91 (1939).—Greenland,[1] Quebec, Alberta, Yukon, British Columbia and Washington. Map 20. Alberta: Banff, June, 1906, *S. Brown 111* (G). Washington: Nisqually River, Mt. Rainier Nat. Park, July, 1937, *G. N. Jones 10274* (G); Nisqually Checking Station, Mt. Rainier Nat. Park, July, 1922, *Abrams 9215* (M, P, RM); moraine of Emmons Glacier, Mt. Rainier, June, 1937, *G. N. Jones 9997* (G); Mt. Rainier Nat. Park, June, 1936, *L. S. Rose 36378* (R); Green River Hot Springs, July, 1888, *Piper 544* (G, WSC); Mt. Angeles, Clallam Co., July, 1931, *Thompson 7427* (M, NY), June, 1934, *Thompson 10603* (M), July, 1931, *J. T. Howell 7454* (G); on low ground in valleys, Skamania Co., July, 1894, *Suksdorf 2354* (G, WSC); headwaters of Robinson Cr., Okanogan Co., July, 1916, *Eggleston 13203* (US); Barnard Trail, Tiffany Mt., July, 1932, *Fiker 1002* (T, WSC). British Columbia: Lake Bootahnie, Marble Mts., June, 1938, *J. W. & E. M. Thompson 87* (G); Mt. Selwyn, July,

[1] For specimens cited from east of the one hundredth meridian, see Hopkins, op. cit. p. 171. These are *A. Holboellii*, var. *typica* with the exception of *Stebbins 798* from Quebec, which is var. *retrofracta*, and the Michigan specimens which are *A. divaricarpa* A. Nels.

1932, *Raup & Abbe 3958* (G). YUKON: Dawson, June, 1914, *Eastwood 134* (Cl, G, in part). ALASKA: Lower Tanana River, May 27, 1936, *Murie s.n.* (L).

37b. Var. RETROFRACTA (Graham) Rydberg. Stems densely pubescent with fine appressed dendritic trichomes to glabrous above; basal leaves pannose to subpannose, usually entire; cauline leaves revolute-margined; pedicels pubescent, strongly reflexed, usually geniculate; petals usually whitish, but often pink; siliques glabrous or sometimes finely pubescent, strongly reflexed, usually appressed to rachis, straight or nearly so, 3.5–8 cm. long, 1–1.5 mm. wide.—Contrib. U. S. Nat. Herb. **3:** 484 (1896); Jepson, Man. Fl. Pl. Calif. 429 (1925) in part. *A. retrofracta* Graham in Edinb. New Phil. Journ. 344 (1829); Watson in King, Geol. Expl. Fortieth Parallel **5:** 18 (1871) in part; Greene, Pitt. **4:** 188 (1900); Rydberg, Fl. Rky. Mts. 362 (1918) in part, and Fl. Pr. Pl. Cent. N. Am. 382 (1932) in part; Jepson, Flora Calif. **2:** 67 (1936) in part; Hopkins in RHODORA **39:** 179 (1937). *Streptanthus virgatus* Nuttall in T. & G., Fl. N. Am., **1:** 76 (1838). *A. Holboellii* sensu Brewer & Wats., Bot. Calif. **1:** 33 (1876); Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895) in part; Piper in Contrib. U. S. Nat. Herb. (Fl. Washington) **11:** 293 (1906). *A. secunda* Howell in Erythea **3:** 33 (1895); Jepson, Flora Calif. **2:** 66 (1936). *A. arcuata* Gray, var. *secunda* (Howell) Robinson in Gray, Syn. Fl. N. Am. **1:** 164 (1895). *A. sparsiflora secunda* (Howell) Piper, op. cit. p. 294. *A. Holboellii* Hornem., var. *secunda* (Howell) Jepson, Man. Fl. Pl. Calif. 430 (1925). *A. rhodantha* Greene, Pitt. **3:** 155 (1897); Rydberg, Fl. Colo. 165 (1906) and Fl. Rky. Mts. 362 (1918); Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909). *A. exilis* A. Nelson in Bull. Torr. Bot. Club **26:** 123 (1899); Coulter & Nelson, l. c.; Rydberg, Fl. Rky. Mts. 363 (1918). *A. tenuis* Greene, Pitt. **4:** 189 (1900). *A. lignipes* A. Nelson in Bot. Gaz. **30:** 191 (1900); Coulter & Nelson, op. cit. p. 229; Rydberg, Fl. Rky. Mts. 362 (1918). *A. consanguinea* Greene, Pitt. **4:** 190 (1900); Rydberg, Fl. Colo. 165 (1906) and Fl. Rky. Mts. 362 (1918). *A. Kochii* Blankinship in Mont. Agri. Coll. Sci. Stud. **1:** 57 (1904), not Jordan, Diag. **1:** 112 (1864). *A. caduca* A. Nelson in Coulter & Nelson, New Man. Bot. Rky. Mts. 229 (1909); Rydberg, Fl. Rky. Mts. 363 (1918). *A. polyantha* Greene, Leaflets **2:** 80 (1910). *A. MacDougalii* Rydberg in Bull. Torr. Bot. Club **39:** 326 (1912). *Turritis retrofracta* (Grah.) Hooker, Fl. Bor.-Am. **1:** 41 (1829). *Sisymbrium pauciflorum* Nuttall ex T. & G., Fl. N. Am. **1:** 93 (1838).—Locally in Quebec and Michigan, more abundant westward from Saskatchewan and Alberta to Colorado, California, Washington, British Columbia and north to Yukon. MAP 21. PRECISE



ROLLINS ON ARABIS

Locality unknown: Rocky Mountains (of Canada), Palliser's Brit. N. Am. Expl. Exped., 1858, *E. Bourgeau s.n.* (G, provisional type). Saskatchewan: junction of north fork and north branch of the Saskatchewan River, June, 1908, *Brown 924* (G); vicinity of Cornwall Bay, Lake Athabaska, July, 1935, *Raup 6446* (G); Charlot Point, Lake Athabaska, June, 1935, *Raup 6081* (G). Alberta: Bow River Valley, vicinity of Banff, June, 1906, *Brown 50* (G); Laggan, Rky. Mt. Park, June, 1904, *Macoun s.n.* (G); Banff, July, 1907, *Butters & Holway 52* (G); Crow Nest Pass, Aug., 1897, *Macoun 18109* (G); Pine Lake district, Wood Buffalo Park, July, 1928, *Raup 2491* (G, Can); Peace Point, Wood Buffalo Park, July, 1928, *Raup 2490* (G). Montana: Bozeman, June, 1906, *Blankinship 554a* (P); Cache Creek, Mineral Co., July, 1933, *C. L. Hitchcock 1754* (G); Wild Horse Island, Flathead Lake, Aug., 1908, *M. E. Jones 8026* (P); near Missoula, June, 1901, *MacDougal 191* (NY, type; US, isotype of *A. MacDougalii* Rydb.; May, 1933, *C. L. Hitchcock 1632* (G); Mud Lake, Ravali Co., Aug., 1933, *C. L. Hitchcock 2075* (G); near Pony, Madison Co., July, 1897, *Rydberg & Bessey 4227* (G, NY). Wyoming: on high hills, sources of the Sweetwater, *Nuttall s.n.* (photo of the type of *Streptanthus virgatus* in Gray Herb.); 5 miles west of Beartooth Lake, Beartooth Mts., Park Co., July, 1939, *Rollins & Muñoz 2859* (G, R); Madison River, Yellowstone Nat. Park, June, 1899, *A. & E. Nelson 5505* (RM, type; G, isotype of *A. lignipes*); 10–15 miles east of Kane, Big Horn Co., June, 1936, *L. O. & R. Williams 3013* (R); near Fremont Lake, Sublette Co., Sept., 1935, *Ownbey 1008* (R); Alpine, Lincoln Co., July, 1923, *Payson & Armstrong 3401* (G, RM); Evanston, June, 1898, *A. Nelson 4523* (RM, type; G, isotype of *A. exilis*); Wind River Mts., Fremont Co., June, 1936, *Costello & Rollins 2067* (G, R); 3 miles north of Lyman, Uinta Co., June, 1937, *Rollins 1657* (G, R); Medicine Bow Mts., Albany Co., July, 1935, *Rollins 1070* (DS, G, R); Woods Creek, Aug. 11, 1896, *A. Nelson 2584* (RM, type of *A. caduca*). Colorado: 4 miles south of Mesa, Mesa Co., May, 1938, *Rollins 2188* (G, R); 2 miles northeast of Cedaredge, Delta Co., May, 1938, *Rollins 2146* (G, R); 5 miles north of Grand Lake, Grand Co., July, 1935, *Rollins 1018* (DS, G, R); 3 miles south of Milner's Pass, Rky. Mt. Nat. Park, June, 1938, *Rollins & Chambers 2402* (G, R); 2 miles south of Pitkin, Gunnison Co., July, 1936, *Rollins 1425* (DS, G, R); near Empire, 1875, *E. L. Greene s.n.* (ND, type of *A. rhodantha;* photo in Gray Herb.); Los Pinos (Bayfield), May 18, 1899, *Baker s.n.* (ND, type; RM, UC, isotypes of *A. consanguinea;* photo in Gray Herb.); near Sargent's, Saguache Co., May, 1938, *Rollins 2087* (G, R). Idaho: forks of St. Marys River, July, 1895, *Leiberg 1161* (G); ridges

south from Weissners Peak, July, 1895, *Leiberg 1404* (G, M, O, P); east of Laird Park, Latah Co., May, 1936, *Rollins & Constance 1108* (G, R, WSC); near Pollock, Idaho Co., May, 1937, *Constance 1854* (G, R); Cuddy Mts., Washington Co., July, 1899, *M. E. Jones* (M, P); Idaho Falls, May, 1924, *Nelson 10051* (RM, UAC); Parker Mt., Custer Co., July, 1916, *Macbride & Payson 3271* (G, P); Elgin, Fremont Co., May, 1919, *Quayle 38* (P); Thunderboldt Mt., Valley Co., July, 1937, *Thompson 13920* (R); Silver City, Owyhee Co., June, 1911, *Macbride 1011* (RM, US). UTAH: Tony Grove Canyon, Cache Co., July, 1936, *Maguire et al. 13959* (UAC); Providence Bench and Providence Canyon, Cache Co., May, 1932, *Maguire 3444 & 3443* (UAC); Salina Canyon, June, 1894, *M. E. Jones s.n.* (P); Lake Point, May, 1880, *M. E. Jones s.n.* (P); Salt Lake Co., June, 1905, *Garrett 1094* (G); Coalville, May, 1889, *M. E. Jones s.n.* (P); 25 miles south of Manila, Uintah Co., June, 1937, *Rollins 1765* (DS, G, R); 12 miles south of Manila, Daggett Co., June, 1938, *Rollins 2268* (G, R); Trout Creek, Juab Co., *Maguire & Becraft 2626* (UAC). NEVADA: Jarbidge, July, 1912, *Nelson & Macbride 1920* (G); July, 1938, *Rollins & Chambers 2579* (G, R); Star Peak, Pershing Co., July, 1901, *M. E. Jones s.n.* (P); about 15 miles southeast of Lamoille, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2548* (G, R); Coleman Pass Canyon, northwestern Washoe Co., June, 1939, *Train 2983* (NA, R); Palisade, June, 1882, *M. E. Jones s.n.* (P); King's Canyon, Ormsby Co., June, 1902, *Baker 891* (G); Sweetwater Mts., near Sweetwater, Mineral Co., July, 1919, *Tidestrom 10204* (G); near Lehman Cr., east of Mt. Wheeler, White Pine Co., July, 1938, *Rollins & Chambers 2470* (G, R). CALIFORNIA: near Big Flat, Siskiyou Co., July, 1937, *J. T. Howell 13203* (G, R); Loy Lake, Siskiyou Co., July, 1910, *Butler 1663 & 1763* (P); Salmon Summit, Humboldt Co., July, 1935, *Tracy 14379* (UC); Rae Lake, Fresno Co., July, 1910, *Mrs. Joseph Clements s.n.* (P); Rock Creek Lake Basin, Inyo Co., Aug., 1937, *Peirson 12183* (Peirs); above Lake Sabrina at the head of Bishop Creek, Aug., 1938, *Constance 2463* (R, UC); Sierra City, Sierra Co., June, 1938, *Constance 2296* (R, UC); lower end of Donner Lake, Nevada Co., July, 1903, *Heller s.n.* (G); Deer Park, Lake Tahoe region, June, 1912, *Eastwood 368* (Cl, G); Baldwin Lake, San Bernardino Co., May, 1932, *Peirson 9966* (Peirs). OREGON: McKenzie Highway, Lane Co., April, 1934, *Eastwood & Howell 1625* (G); Swan Valley, Klamath Co., June, 1896, *Applegate 29* (G); Abbott Butte, Jackson Co., July, 1936, *Thompson 13055* (G, R); Wallowa Lake, Wallowa Co., Aug., 1935, *Constance & Jacobs 1315* (UC, US, WSC); near Anthony Lake, Blue Mts., Baker Co., July, 1938, *Rollins & Chambers 2599* (G); Powder River Mts., Aug., 1896,

Piper 2504 (G, WSC); Blue Mts., Grant Co., June, 1925, *Henderson 5290* (US). WASHINGTON: Malden-Pine City, Whitman Co., May, 1936, *Rollins & Constance 1092* (G, R); near Spokane Bridge, Spokane Co., May and July, 1916, *Suksdorf 8567* (G, R, UC, US, WSC); near Caisy, Stevens Co., May, 1937, *Constance 1841* (G, R); Kettle Falls, Ferry Co., May, 1937, *Constance 1842* (G, R); Metaline, Pend Oreille Co., June, 1933, *Thompson 9224* (G); Godman Springs, Columbia Co., July, 1935, *Constance et al. 1191* (WSC); Barron, Whatcom Co., Aug., 1937, *Muenscher 7882* (G); Mt. Adams, Aug., 1882, *Howell 1487* (O, TYPE; NY, UC, US, WSC, isotypes of *A. secunda* Howell); Rock Island, Chelan Co., April, 1899, *Whited 1043* (US, TYPE; OS, WSC, isotypes of *A. polyantha* Greene); on mountains, w. Klickitat Co., May, 1884, and July, 1885, *Suksdorf 15* (ND, TYPE; G, R, isotypes of *A. tenuis* Greene). BRITISH COLUMBIA: Peace River at Taylor Flat, June, 1932, *Raup & Abbe 3573* (G); shore of Howser Lake, June, 1905, *Shaw 711* (G); Kicking Horse Valley, vicinity of Field, June, 1906, *Brown 351* (G); five miles north of Birch Island, North Thompson River, May, 1935, *McCabe 1891* (G); Carson Mt., Marble Mts., June, 1938, *J. W. & E. M. Thompson 319* (G); south of Kamloops, May, 1938, *J. W. & E. M. Thompson 41* (G); Cranbrook, May, 1930, *Grove s.n.* (G). YUKON: White Horse, Sept. 2, 1902, *Macoun* (Can. 54359); Hunker Creek, July 31, 1902, *Macoun* (Can. 58357); Lake Bennett, July 8, 1902, *Macoun* (Can. 58356); White Horse Rapids, *Tarleton 30* (NY); Klondike-Dawson, July 11, 1902, *Macoun* (Can. 58355).

37c. Var. **Collinsii** (Fernald), comb. nov. Stems 2–6 dm. high, hirsutulous below with coarse spreading simple or branched trichomes, glabrous above; cauline leaves auriculate at base, lower finely pubescent, upper glabrate; pedicels strongly reflexed, geniculate, sparsely pubescent to glabrous; petals white to pinkish, 6–8 mm. long, 2–3 mm. broad; siliques glabrous, straight, nerved to middle or slightly beyond, usually strictly reflexed.—*A. Collinsii* Fernald in RHODORA **7:** 32 (1905); Britton & Brown, Ill. Fl. **2:** ed. 2, 183, fig. 2082 (1913); Marie-Victorin, Fl. Laurent. 261 (1935). *A. pendulocarpa* sensu Hopkins in RHODORA **39:** 183 (1937) in part.—Rimouski County, Quebec;[1] Manitoba, Alberta, South Dakota, Montana and Wyoming. MAP 22. MANITOBA: north of Carberry, June, 1906, *Macoun & Herriot 69860* (G). ALBERTA: vicinity of Rosedale, April, 1915, *Moodie 823* (G, NY); near Banff, July, 1931, *Pease 22441* (G). SOUTH DAKOTA: Custer Peak, Lawrence Co., June, 1929, *Palmer 37545* (G); near Savoy, June, 1910, *J. Murdoch, Jr. 4116* (G). MONTANA: near Missoula, June, 1918, *Collins s.n.* (G),

[1] For citations of specimens from Quebec, see Hopkins, op. cit. p. 184 under *A. pendulocarpa* A. Nels.

July, 1933, *C. L. Hitchcock 1839* (G, R); above Bonner, Missoula Co., July, 1933, *C. L. Hitchcock 1686* (G); 30 miles south of Missoula, Ravali Co., May, 1933, *C. L. Hitchcock 1569* (G) in part; Spanish Creek, Gallatin Co., May, 1901, *J. Vogel s.n.* (G) in part; Bridger Pass, Gallatin Co., Aug., 1916, *Suksdorf 53* (G); Westby, Sheridan Co., June, 1927, *Esther Larsen 21* (G); 17 miles southwest of Red Lodge, Carbon Co., July, 1939, *Rollins & Muñoz 2830* (G, R). Wyoming: near Hulett, Crook Co., May & June, 1935, *Ownbey 532, 532a, 545*, in flower; *545a, 532b* in fruit (R), May, 1935, *Ownbey 551a* (G); Yellowstone River, near Junction Butte, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson 5728* (RM).

37d. Var. **pendulocarpa** (A. Nels.), comb. nov. Stems slender, usually simple, pubescent below with coarse simple or branched, often spreading trichomes, glabrous above, 1–2.5 dm. high; cauline leaves acute, not auriculate at base; basal leaves entire; pedicels arched downward, not strictly reflexed nor straight; siliques pendulous, straight or very slightly curved inward.—*A. pendulocarpa* A. Nelson in Bot. Gaz. **30:** 192 (1900); Rydberg, Fl. Rky. Mts. 363 (1918); Hopkins in Rhodora **39:** 183 (1937) in part. *A. canescens* sensu Rollins in Res. Stud. State Coll. Wash. **4:** 35, fig. 9 (1936).—Montana to Colorado, California and British Columbia. Map 22. Montana: Missoula, April, 1921, *Kirkwood 1133* (Cl, NY), March and April, 1915, *Kittredge s.n.* (G), May, 1933, *C. L. Hitchcock 1592* (G, P, RM); 5 miles east of Perma, May, 1933, *C. L. Hitchcock 1551* (G, P, R, RM); 12 miles west of Wilsall, Park Co., July, 1921, *Suksdorf 352* (R). Wyoming: Yellowstone Nat. Park, Aug. 1922, *E. B. & L. B. Payson 3105* (RM), May, 1902, *Mearns 753* (US); Madison River, Y. N. Park, June, 1899, *A. & E. Nelson 5504* (RM, type; G, NY, US, isotypes); Piney Mt., Sublette Co., July, 1922, *E. B. & L. B. Payson 2678* (G, NY, RM, US); Gros Ventre Fork (Snake R.) June, 1860, *Heyden 71* (M); Sheep Mt., Lincoln Co., July, 1923, *Payson & Armstrong 3446* in part (G, RM); Wind River Mts., Fremont Co., June, 1936, *Costello & Rollins 2047* (G, R); 6 miles west of Jackson, Teton Co., June, 1936, *L. O. & R. Williams 3008b* (R). Colorado: near Kings Canyon, Jackson Co., June, 1925, *E. B. & L. B. Payson 4252* (RM). Idaho: Henry Lake, July, 1920, *E. B. & L. B. Payson 1971* (G, NY, RM); Mt. Borah, near Chilly, Custer Co., June, 1939, *Christ & Ward 10643* (Herb. J. H. Christ); forks of Big Creek, Custer Co., May, 1932, *A. M. Cusick 163* (FS); Gallagher Canyon, Lemhi Forest, May, 1928, *Schulze 47* (FS); south end of Soldier Mts., Blaine Co., June, 1916, *Macbride & Payson 2898* in part (G, RM, UC, US). California: Warren Peak, head of Parker Creek, Modoc Co., July, 1917, *Smith 55* (FS); one-

half mile southeast of King's Castle, Siskiyou Co., July, 1939, *Hitchcock & Martin 5322* (G, R). OREGON: Strawberry Butte, Blue Mts., July, 1896, *Coville 552* (US). WASHINGTON: Beehive-Cashmere Trail, Wenatchee Forest, May, 1925, *Ingram 1956* and *1960* (FS, OS); Summit of Bald Mt., Valley of Nile Creek, Rainier Nat. Forest, Yakima Co., July, 1923, *St. John 7856* (WSC); Mt. Adams, July, 1906, *Suksdorf 5751* (WSC); Hurricane Ridge, Clallam Co., July, 1933, *G. N. Jones 4017* (UW), July, 1931, *G. N. Jones 3406* and *3201* (UW); Mt. Angeles, July, 1931, *G. N. Jones 3322* (UW). BRITISH COLUMBIA: Midway, April, 1905, *Spreadborough 70817* (G, NY); Yale, May, 1889, *J. Macoun s.n.* (G); Carbonate Draw, July, 1904, *Hescock 3091* (G); Penticton, April, 1903, *Spreadborough 59558* (G, NY); near Lake Boothanie, Marble Mts., June, 1938, *J. W. & E. Thompson 155* (G).

37e. Var. **pinetorum** (Tidestrom), comb. nov. Stems hirsutulous below with simple, branched or dendritic trichomes, glabrous above, 3–9 dm. high; basal leaves broadly oblanceolate to more narrowly so, densely pubescent with coarse dendritic trichomes; pedicels usually slightly arched downward, rarely geniculate, usually glabrous; siliques slightly curved inward, sometimes straight, glabrous, 4–7 cm. long, 1.5–2 mm. wide.—*A. pinetorum* Tidestrom in Proc. Biol. Soc. Wash. **36:** 182 (1923) and Contrib. U. S. Nat. Herb. (Fl. Utah and Nevada) **25:** 245 (1925). *A. Holboellii*, var. *retrofracta* sensu Munz, Man. So. Calif. Bot. 205 (1935). *A. retrofracta* sensu Jepson, Fl. Calif. **2:** 67 (1936) in part.—Southern Saskatchewan, Nebraska and Colorado to California and British Columbia. MAP 20. SASKATCHEWAN: Wood Mountain Post, June, 1895, *Macoun 5933* (P). NEBRASKA: Ft. Robinson, June, 1890, *J. M. Bates s.n.* (G). WYOMING: Plumbago Canyon, Albany Co., June, 1930, *Nelson 11307* (G, RM); Laramie Hills, May, 1896, *Nelson 1885* (G). COLORADO: South Park, 1873, *Wolf & Rothrock 655* (G); Alvarado Ranger Station, Custer Co., June, 1936, *Rollins 1246* (G, R); La Veta Pass, Costella Co., June, 1936, *Rollins 1288a* (G, R); 10 miles east of Leadville, Lake Co., July, 1936, *Rollins 1349* (G, R); Monarch Pass, Chaffee Co., July, 1936, *Rollins 1343a* (R); 2 miles south of Pitkin, Gunnison Co., July, 1936, *Rollins 1426* (DS, G, R); 6 miles east of Gunnison, Gunnison Co., May, 1938, *Rollins 2095* (G, R). IDAHO: Salmon, Lemhi Co., June, 1920, *E. B. & L. B. Payson 1788* (G); Silver City, Owyhee Co., June, 1911, *Macbride 934* (G). UTAH: Providence Canyon, Cache Co., May, 1933, *Muenscher & Maguire 2346* (UAC); Wasatch Mts., May, 1867, *Bailey 76* (G); Summit Springs Ranger Station, Daggett Co., June, 1932, *L. O. Williams 567* (G); Fish Lake, Aug., 1894, *Jones 5770a* (P); Marysvale,

June, 1894, *Jones 5353* (P). Nevada: Duck Creek, Shell Creek Mts., July, 1924, *Jones s.n.* (P), Aug., 1880, *Jones s.n.* (P); 2 miles south of Lehman Creek, near base of Mt. Wheeler, White Pine Co., July, 1938, *Rollins & Chambers 2485* (G, R); west slope of Pioche Mt., Lincoln Co., April, 1939, *Train 2666* (NA, R); 12 miles north of Pioche, Lincoln Co., May, 1939, *Train 2676* (G); Glenbrook, Lake Tahoe, July 7, 1919, *Tidestrom 10387* (US, type), July 6, 1919, *Tidestrom 10279* (G). California: near Etna, Siskiyou Co., June, 1937, *Eastwood & Howell 5031* (R); One Thousand Lake Basin, Shasta Co., July, 1932, *Peirson 10152* (Peirs); Lake Tahoe, Eldorado Co., June, 1932, *Maguire et al. 15046* (UAC); Cave Rock, Lake Tahoe region, 1909, *Eastwood 157* (Cl); 4 miles west of Sonora Pass, Alpine Co., Aug., 1938, *Constance 2405* (R); Glen Alpine Canyon, July, 1937, *Abrams 13412* (G, P); Tuolumne Meadows, Aug., 1916, *Smiley 758* (G); Mineral King, July, 1891, *Coville & Funston 1388* (G); Yosemite Valley, June, 1911, *Abrams 4452* (G); San Bernardino Mts., June, 1926, *Munz 10474* (P), July, 1924, *Munz & Johnston 8481* (P), July, 1902, *Abrams 2830* (G); Laguna Mts., San Diego Co., June, 1924, *Munz 8362* (P), May, 1925, *Peirson 5922* (Peirs). Oregon: Hoover Creek, Lillian Co., June, 1894, *Leiberg 132* (G); Ashland-Klamath Falls, July, 1920, *Peck 9232* (G). Washington: base of Mt. Adams, June, 1883, *Suksdorf 97* and *1915* (G); North Yakima, May, 1892, *Henderson 2393* (G); upper Yakima (River), Wash. Terr., 1860, *Lyall* (G); Swauk River, Kittitas Co., May-Sept., 1913, *Sharples 83* (G).

Critical students have often toiled with the numerous and seemingly unpredictable variations of *Arabis Holboellii* which occur in various parts of its natural geographical range. Some, including two recent authors,[1] have taken the stand that two or several species are represented by the plants which are here included under the single species with its varieties. However, there is no clear hiatus between the varieties as they are presented above, nor are there significant morphological differences between them. Hopkins l. c. who treated most of the "*Holboellii* complex", did not detect var. *typica* from western Washington or British Columbia. By thus limiting the distribution of typical *A. Holboellii* to Greenland and a few isolated stations in eastern America, it is admittedly easier to argue that "*A. retrofracta*" and "*A. pendulocarpa*", which are found chiefly in the Cordillera of western North America, are distinct species.

[1] Jepson, Flora Calif. **2**: 66–68 (1936) and Hopkins in Rhodora **39**: 170–186 (1937).

The facts are, as I see them, that the gradation of characters throughout the varietal series is too complete to allow the admission of even the leading varieties to specific rank. The varieties here recognized, as shown by the key, are based on trivial characters of pubescence and habit. They may not be entirely natural in every case, but the arrangement is orderly and the recognizable entities are easily determined as part of the species as a whole.

Such criteria as petal-size and the coarseness or fineness of stem-pubescence must be used with extreme care in the delimitation of *Arabis*-species. In measuring petal-width in the entity treated as *A. pendulocarpa* by Hopkins, for example, the measurement was found to vary from less than 1 mm. to more than 3 mm. Petal-length is equally variable, depending both on the stage of development and to a small extent on the position of the flower in the inflorescence. The last flowers to develop near the apex of the raceme often fail to attain the size of the lower ones which mature much earlier.

As regards pubescence in this immediate group, one must be equally wary. The young leaves in *A. Holboellii*, var. *typica* tend to be pannose, but as the leaf fully expands, the density of the pubescence decreases and one observes a spaced relationship between the dendritic trichomes. Var. *pendulocarpa*, var. *Collinsii* and var. *pinetorum* possess a coarse, spreading, almost hirsutulous type of pubescence on the lower stem and in general this character serves well to distinguish them from var. *retrofracta* and var. *typica*, but here again one finds a perplexing gradation from a coarse to a fine type of indument. The stem-pubescence of typical *A. Holboellii* is, in fact, about half-way between that of var. *retrofracta* and var. *pendulocarpa*. It is also significant that many of these gradations occur in specimens gathered at a single station; for example, the four sheets of the type-collection of var. *pendulocarpa* are quite variable with respect to the coarseness of stem-pubescence and two plants mounted on the same sheet at the Gray Herbarium, representing C. L. Hitchcock's no. 1569 from Ravali County, Montana, have the extremes in coarseness and fineness of stem-pubescence, but are otherwise nearly identical. The proximity or remoteness of cauline leaves in this species is correlated with the stage of

development of the plant. Young plants nearly always have the cauline leaves closely imbricated, but as the stem lengthens these leaves may become separated by a centimeter or more.

A photograph of the type of *Streptanthus virgatus* Nuttall shows clearly that the specimen is an *Arabis*, but the accurate determination of the species cannot be made from the photograph alone. The single plant which constitutes the type is in flower only and resembles closely flowering specimens of *A. Holboellii*, var. *retrofracta*. However, a direct examination of the plant may show that it is really the same as the species which bears the name *A. lignifera* in the present work.

The complex nature of *A. Holboellii* is, in part at least, to be associated with the existence of polyploidy in the species. The common, wide-spread var. *retrofracta* is usually diploid, as shown by the cytological examination of six collections from California, Wyoming and Colorado, but a single collection from Utah was found to be tetraploid. Two collections of var. *pinetorum* from Colorado have proved to be polyploids, one tetraploid, the other hexaploid. Böcher[1] has reported the chromosome number of var. *typica* as $n = 22$. This count is not compatible with those I have made from other varieties of the species nor with other counts in the genus. The significance of such a number in this group is not at present understood. The effect of polyploidy in widening the range of variation within a given species seems to be borne out by such data as are available on *A. Holboellii*, but considerably more work on the cytology, genetics and geographical distribution of this species will be necessary before the complete story will be known.

38. A. PUBERULA Nuttall. Biennial or perennial; stems often stout, single or few from a simple caudex, simple or branched above, hoary throughout with a dense, dendritic pubescence, rarely becoming glabrous above, 1.5–5 dm. high; basal leaves dimorphic, oblanceolate to linear-oblanceolate, entire or few-toothed, acute, hoary with a minute dendritic pubescence, petiolate, 1–2 (–3) cm. long, 3–6 mm. wide; cauline leaves numerous, crowded, lanceolate to oblong, acute, entire or the lower irregularly toothed, sessile, densely pubescent, 1–3 cm. long, auricles small or absent; sepals oblong, densely pubescent, 4–6 mm. long, about 1.5 mm. wide, non-saccate; petals rose to

[1] Reprint from Meddelelser om Grønland **106**: 100 (1938).

purple, rarely white, spatulate to narrower, 7–11 mm. long, 1.5–2.5 mm. wide; glandular tissue rather poorly developed, continuous beneath all stamens; fruiting pedicels curved downward, often strictly reflexed, densely pubescent, 4–8 mm. long; siliques numerous, pendulous to rather strictly reflexed, straight, usually blunt at apex, one-nerved below the middle, densely pubescent or less so in age, 3–6 cm. long, 2–3 mm. wide; stigma sessile; seeds orbicular, plump, narrowly winged, slightly less than 2 mm. broad, uniseriate.—In T. & G., Fl. N. Am. **1:** 82 (1838); Piper in Contrib. U. S. Nat. Herb. **11:** 294 (1906) in part. *A. canescens* sensu Watson in Gray, Syn. Fl. N. Am. **1:** 165 (1895) in part; Rydb., Fl. Rky. Mts. 363 (1918) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 245 (1925) in part; Jepson, Fl. Calif. **2:** 67 (1936) in part. *A. Beckwithii* Watson in Proc. Am. Acad. **22:** 467 (1887) in part, and in Gray, Syn. Fl. N. Am. **1:** 165 (1895) in part; Tidestrom l. c. in part. *Erysimum puberulum* (Nutt.) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891). *A. subpinnatifida*, var. *Beckwithii* (Wats.) Jepson, Man. Fl. Pl. Calif. 431 (1925). *A. arida* Greene, Pittonia **4:** 190 (1900). *A. lignipes*, var. *impar* A. Nelson in Bot. Gaz. **54:** 139 (1912). *A. subpinnatifida*, var. *impar* (A. Nels.) Rollins in Res. Stud. State Coll. Wash. **4:** 32, fig. 8 (1936). *A. sabulosa* Jones, Contrib. West. Bot. **14:** 40 (1912). *A. sabulosa*, var. *frigida* Jones, ibid. p. 41. *A. sabulosa*, var. *colorata* Jones, ibid.—Idaho to Nevada, California and Washington. MAP 18. WITHOUT DEFINITE LOCALITY: Blue Mts., Columbia (probably Washington or Oregon), *Nuttall s.n.* (Ph, isotype; photo of TYPE in Gray). IDAHO: 2 miles from Salmon, Lemhi Co., May, 1924, *Romano 8* (FS); Middle Valley (Midvale), Washington Co., April, 1900, *Jones 6167* (UC, US); Squaw Creek (Sweet), May, 1911, *Macbride 828* (RM, TYPE; C, UC, US, isotypes of *A. lignipes*, var. *impar*); Rattlesnake Creek near Dixie, Elmore Co., June, 1916, *Macbride & Payson 2855* (G, NY, RM, US); Picabo, Blaine Co., July, 1916, *Macbride & Payson 2996* (G, NY, RM, UC, US); Kingport Peak, near Pocatello, Bannock Co., May, 1925, *Soth 539* (NY). NEVADA: near Owyhee, June, 1937, *Murphy 210* (R); Wendover, Elko Co., June, 1934, *Maguire et al. 5806* (UAC); Moor's Station, Elko Co., May, 1896, *E. L. Greene s.n.* (ND, TYPE of *A. arida;* photo in Gray); Palisade, Eureka Co., June, 1882, *Jones 3761* (P, TYPE; Cl, NY, UAC, UC, US, isotypes of *A. sabulosa*); 15 miles west of Round Mountain, Toiyabe Mts., Nye Co., July, 1938, *Rollins & Chambers 2509* (G, R); Paradise Valley, Humboldt Co., April, 1905, *Kennedy 1065* (RM); Swan Lake, northern Washoe Co., June, 1939, *Train 3008* (G, NA, R); (West) Humboldt Mts., Pershing Co., June, 1868, *Watson 76* (G); July, 1894, *Greene s.n.* (ND); Lower Rochester, Pershing

Co., June, 1937, *Train 38* (R); Carson City, Ormsby Co., April, 1868, *Watson 76* (G); Kings Canyon, Ormsby Co., June, 1902, *Baker 985* (G, ND, NY); Nevada?, Quartz Mts.?, west of Great Salt Lake! *Lieut. Beckwith* (G, TYPE of *A. Beckwithii*). CALIFORNIA: Mt. Eddy, Siskiyou Co., July, 1920, *Heller 13434* (DS, P, US); Fort Bidwell, Modoc Co., July, 1903, *Manning 100b* (UC); Goose Lake Valley, May, 1894, *Austin 30* (ND, UC); above Parker Creek, Modoc Co., June, 1919, *Ferris & Duthie 65* (DS); Bieber Range, Lassen Co., June, 1920, *Smith 1200* (FS); Dixey Mts., Lassen Co., July, 1894, *Baker & Nutting s.n.* (UC); Diamond Mt., near Susanville, June 28, 1897, *M. E. Jones s.n.* (P, TYPE of *A. sabulosa*, var. *frigida*); vicinity of Doyles Station, Lassen Co., May, 1911, *Eggleston 6702* (US); Summit, Sierra Co., 1873, *Bolander 338* (M); Summit, Owens Valley, May 19 & 20, 1897, *M. E. Jones s.n.* (P, TYPE? of *A. sabulosa*, var. *colorata*). OREGON: Juniper Springs, Malheur Co., June, 1896, *Leiberg 2261* (G, NY, UC, US); Harper Ranch, Malheur Co., May, 1896, *Leiberg 2092* (G, O, UC, US); Camp Harney, Harney Co., May, 1885, *T. Howell s.n.* (G, O, US); near Prairie City, Grant Co., June, 1925, *Henderson 5289* (O); Forked Horn Butte, near Laidlaw, Crook Co., June, 1919, *Whited 99* (G, US, WSC); Deschutes Co., Aug., 1920, *Peck 9762* (W); Hart Mt., Lake Co., July, 1933, *L. Constance* (Henderson no. 15758) (O); Ingram Butte, Lake Co., July, 1929, *Ingram 3070* (FS); Pelican City, Klamath Co., May, 1923, *Applegate 3510* in part (DS, O); Brookside Ranch, Swan Lake Valley, Klamath Co., June, 1923, *Applegate 3586* (DS). WASHINGTON: Ellensburg, Kittitas Co., May, 1897, *Piper 2707* (WSC); Tampico, Yakima Co., May, 1899, *Flett 1125* (WSC); Cleman Mt., Yakima Co., June, 1892, *Henderson 2389* (G, UW); near Bickleton, Klickitat Co., April, 1934, *Pickett et al. 1463* (WSC).

Arabis puberula is related to *A. subpinnatifida* and to *A. Holboellii*, var. *retrofracta*. As pointed out elsewhere, more abundant and accurate information on the life-histories of these plants may show that *A. subpinnatifida* should be given only subordinate rank under *A. puberula*. In habit and disposition of siliques, *A. puberula* resembles *A. Holboellii*, var. *retrofracta*, but ordinarily it can be distinguished by the fact that the siliques are densely pubescent, instead of being glabrous or only sparsely pubescent. The basal leaves of *A. puberula* tend to be dimorphic as in *A. subpinnatifida*. The leaves of the sterile shoots and first-year rosettes are much longer, narrower and more acuminate than the basal leaves of the fruiting stems.

The pubescence of *A. puberula* is hoary, being extremely dense on the stems, leaves and usually on the siliques. The seeds and siliques are broader and the flowers somewhat larger than any found in *A. Holboellii,* var. *retrofracta.*

In a former paper[1] *A. puberula* was treated and illustrated as *A. subpinnatifida,* var. *impar.* At that time the application of *A. puberula* was not properly known to me. Observing that plate 359 in Hooker's Icones Plantarum,[2] labeled *Arabis puberula,* was "taken from a specimen obligingly sent to us—by Mr. Nuttall", I had supposed the illustration to have been taken from an isotype or at least authentic material. Now that photographs of Nuttall's types of *A. canescens* and *A. puberula* in the British Museum have been obtained and isotype material of both has been examined at the Academy of Natural Sciences of Philadelphia, it is clear that Hooker illustrated Nuttall's *A. canescens,* but gave the description and locality of *A. puberula.* This mix-up has been the source of a seemingly perpetual misinterpretation of both *A. puberula* and *A. canescens.* Hooker's illustration is actually *A. cobrensis* Jones under which *A. canescens* Nuttall, being a later homonym, must now be placed.

The synonyms of *A. puberula* listed above are clear, except perhaps *A. Beckwithii.* When Watson described the latter species he cited four collections, without designating a type, as follows: "Nevada (Quartz Mountains, *Beckwith;* near Carson City, *Watson;* Candelaria, *Shockley*); San Bernardino Mountains, California (*Parish Brothers,* 1302)". The Beckwith and Watson specimens, though only in flower, appear to be merely *A. puberula.* The other two obviously belong to a different species and have been named *A. Shockleyi* by Munz. If, as seems reasonable, we are to associate the name *A. Beckwithii* with the Beckwith specimen as type, then the name must fall into the discard as a synonym of the older *A. puberula.*

39. A. SUBPINNATIFIDA Watson. Perennial; stems one to few from a simple or branched caudex, simple or branched above, densely pubescent with fine dendritic trichomes throughout or glabrous above, 1.5–4 dm. high; basal leaves dimorphic, leaves at base of flowering stems linear to linear-oblanceolate, acute, petiolate, dentate to somewhat incised, rarely entire, hoary with

[1] Res. Stud. State Coll. Wash. **4**: 32 (1936).
[2] Icones Plant. **4**: tab. 359 (1841).

a fine, dense, dendritic pubescence, 1–3 cm. long, 2–4 mm. wide, leaves of the sterile shoots narrowly linear-oblanceolate, acuminate, usually entire, 2–5 cm. long, densely pubescent; cauline leaves lanceolate to linear-lanceolate, acute, revolute, sessile or the lower having the suggestion of a petiole, subpinnatifid to irregularly dentate, rarely almost entire, hoary, 1–3 cm. long, 2–6 mm. wide, auricles small or absent; sepals oblong, scarious-margined, densely pubescent, often purplish, 5–7 mm. long; petals spatulate to lingulate, purple to lavender, 10–14 mm. long, 2–3 mm. wide; glandular tissue weakly developed, continuous under all stamens; flowering pedicels erect to divaricate; fruiting pedicels arched downward, pubescent, rather stout, 6–12 mm. long; siliques pendent, straight to slightly curved inward, glabrous to sparsely pubescent, 5–7 cm. long, 2–3.5 mm. wide, apex acuminate; style about 1 mm. long; seeds orbicular to slightly oblong, winged on the sides or sometimes all around, 1.5–2.5 mm. broad including wings, uniseriate.—Proc. Am. Acad. **20:** 353 (1885) and in Gray, Syn. Fl. N. Am. **1:** 165 (1895) in part; Howell, Fl. Northw. Am. **1:** 46 (1897); Jepson, Man. Fl. Pl. Calif. 431 (1925) and Fl. Calif. **2:** 65 (1936); Rollins in Res. Stud. State Coll. Wash. **4:** 30, fig. 7 (1936).—Oregon and California; Siskiyou Co.: Callahan, *Eastwood & Howell 5024* (R); east of Etna, April, 1938, *Horn 28* (G); Scott Valley, April and June, 1876, *Greene 711* (G, ND); Yreka, April, 1914, *L. E. Smith 636* (G). Trinity Co.: Mary Blaine Mt., Aug., 1935, *Tracy 14442* (UC); Trinity River Canyon, *Eastwood & Howell 4975* (R). Humboldt Co.: Grouse Mt., July, 1933, *Tracy 12878* (UC). Oregon: Jackson Co.: above Inns, July, 1930, *Henderson 12863* (O); Anderson's Camp east of Abbott Butte, July, 1899, *Leiberg 4279* (O, US); Abbott Butte, July, 1936, *Thompson 13057* (R, T). Josephine Co.: Waldo, June, 1884, *T. Howell s.n.* (G, type; NY, T, US, isotypes); Kerby, April, 1926, *Henderson 5918* (M, O, RM); Rogue River near Galice, April, 1926, *Henderson 5917* (M, O, RM); Sexton Mt., April, 1934, *Thompson 10248* (T, US, W); near Merlin, March, 1927, *Peck 14775* (NY, W); Takilma, June, 1918, *Peck 8422* (G, W).

There is some question as to whether *A. subpinnatifida* should be kept up as a species now that the identity of Nuttall's *A. puberula* is clear. The plants formerly treated[1] as *A. subpinnatifida*, var. *impar* undoubtedly should be referred to *A. puberula*. In order to place these two entities in the same relationship nomenclaturally, it would be necessary to place *A. sub-*

[1] Res. Stud. State Coll. Wash. **4:** 32 (1936).

pinnatifida in varietal rank under *A. puberula.* This I should hesitate to do unless further investigation should indicate a closer affinity between the two than is now apparent. Ordinarily the two species will not be confused except, perhaps, in an area where they come together in western Nevada and northeastern California. *A. subpinnatifida* differs from *A. puberula* in having larger flowers and broader siliques. The siliques are acuminate at the apex, the style is about 1 mm. long and the cauline leaves are usually subpinnatifid in the former species. In *A. puberula* the cauline leaves are usually entire and the smaller, blunt siliques lack a definite style, the stigma being quite sessile.

Of the three specimens cited in the original publication of *A. subpinnatifida,* the specimen from the "West Humboldt Mts., Nev.", is *A. puberula.* The other two represent the species as here interpreted.

40. A. COBRENSIS M. E. Jones. Perennial; stems slender, several to many from a branched caudex, simple or usually branched above, softly pubescent with minute dendritic trichomes below, glabrate above, 2–5 dm. high; basal leaves numerous, entire, linear, acute, densely and finely pubescent with minute dendritic trichomes, hoary, 2–5 cm. long, 1–3 mm. wide; cauline leaves few, narrowly linear, entire, sessile, inconspicuously auriculate, often subtending a flower or branch, densely pubescent, 1–3.5 cm. long, 1–3 mm. wide; flowers small; sepals oblong, obtuse, non-saccate, sparsely pubescent, scarious-margined, 2–3 mm. long; petals white, narrowly clawed, about 4 mm. long, 1 mm. wide; glandular tissue continuous beneath all stamens; stamens nearly equal; fruiting raceme open; siliques straight or nearly so, pendulous or widely descending, sparsely pubescent pedicels, one-nerved below the middle, glabrous, obtuse, 3–5 cm. long, about 2 mm. wide; style very short or absent; seeds slightly oblong to nearly orbicular, about 2 mm. long, uniseriate, rather widely winged, wing about 0.5 mm. wide.—Contrib. West. Bot. **12:** 1 (1908). *A. canescens* Nuttall ex T. & G., Fl. N. Am. **1:** 83 (1838); Watson in Gray, Syn. Fl. N. Am. **1:** 165 (1895) in part; Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909) in part; Rydberg, Fl. Rky. Mts. 363 (1918) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 245 (1925) in part, not *A. canescens* Brocchi in Bibleot. Ital. **29:** 90 (1823). *A. puberula* sensu Hooker, Icon. Pl. **4:** t. 359 (1841); Rollins in Res. Stud. State Coll. Wash. **4:** 34 (1936). *A. crypta* A. Nelson in Bot. Gaz. **56:** 473 (1913); Tidestrom, op. cit. p. 244.—Wyoming to Nevada and Oregon. MAP 17. LOCALITY UNCER-

TAIN: R.(ocky) Mts., *Nuttall s.n.* (G, Ph, isotypes of *A. canescens* Nutt.; photo of TYPE from Herb. Brit. Mus. in Gray Herb.). WYOMING: Orenda Butte, Red Desert, Sweetwater Co., June, 1900, *Nelson 7131* (RM); Point of Rocks, Sweetwater Co., June, 1897, *Nelson 3077* (G, M, RM, US); between Eden and Big Piney, Sublette Co., July, 1922, *E. B. & L. B. Payson 2569* (G, M, RM, UC, US); 3 miles north of Lyman, Uinta Co., June, 1937, *Rollins 1656* (G, R), June, 1938, *Rollins 2287* (G, R); Granger, Uinta Co., June, 1898, *Nelson 4700* (RM). IDAHO: desert near Big Butte, Butte Co., *R. J. Davis 167* (UIP). NEVADA: Cobre, Elko Co., June 16, 1906, *M. E. Jones s.n.* (P, TYPE; M, UC, US, isotypes); Jarbidge, Elko Co., July 4, 1912, *Nelson & Macbride s.n.* (RM, TYPE of *A. crypta*); Paradise Valley, Humboldt Co., April, 1905, *Kennedy 1055* (RM); Winnemucca, May, 1917, *Wooton s.n.* (US); 5 miles north of Poeville, Washoe Co., June, 1938, *Tollotson 101* (R, VTM); Empire City, June, 1882, *Jones 3762* (Cl, M, US). OREGON: near Gateway, Jefferson Co., June, 1925, *Peck 13808* (W); between Prineville and Button Springs, Crook Co., June, 1894, *Leiberg 342* (US); camp at Dry Creek, Crook Co., July, 1894, *Leiberg 342* (G, O, UC); Fort Rock, Lake Co., June, 1911, *Eggleston 6835* (NY, US); base of Steens Mts., Harney Co., June, 1901, *Cusick 2567* (G, M, O, RM, UC, US, WSC).

This species was treated as *A. puberula* in a former paper.[1] The misapplication of the name was made as a result of my having followed the plate in Hooker's Icones Plantarum.[2] In the latter work, Nuttall's *A. canescens* is figured, but the plate is given as *A. puberula* Nutt., which is actually an entirely different species. An explanation of this error is given more fully under *A. puberula*.

A. cobrensis is found in the semi-arid to arid desert regions of the Great Basin area of western America. The stems are weak and often depend upon sagebrush or similar shrubby plants for support and protection. Its nearest relative is *A. puberula*, from which it differs in having remote instead of imbricated cauline leaves, glabrous instead of pubescent siliques and long linear basal leaves in place of short narrowly oblanceolate ones. *A. crypta* is based on an aberrant specimen of *A. cobrensis*. The type of *A. crypta* has abnormally short siliques caused by a high percentage of aborted ovules.

[1] Res. Stud. State Coll. Wash. **4**: 34 (1936).
[2] Hook. Icon. Pl. **4**: t. 359 (1841).

Otherwise the distinctive characters of *A. cobrensis* are unmistakably present. *A. cobrensis* is relatively homogeneous compared to many species of *Arabis*.

41. A. Shockleyi Munz. Perennial, hoary with a fine dendritic pubescence; caudex simple, invested by old leaves and leaf-bases; stems one to few, simple to branched above, stout, densely pubescent throughout with minute dendritic trichomes, 1.5–3 dm. high; basal leaves crowded, spatulate, entire, short-petioled, hoary, 1–2 cm. long, 4–6 mm. broad; cauline leaves broadly lanceolate, acute, auricled but not clasping the stem, approximate, 1–1.5 cm. long, 3–6 mm. wide; sepals linear-oblong, pubescent, non-saccate, 5–7 mm. long, 1–1.5 mm. wide; petals linear-lanceolate, obtuse, pink, 8–11 mm. long, gradually tapering from blade to claw; glandular tissue continuous beneath all stamens, not highly developed; pedicels ascending, densely pubescent, 8–12 mm. long; siliques divaricate, crowded at apex of stem, straight to slightly curved, sparsely pubescent or glabrous, nerved at base only, often purplish, 5–8 cm. long, about 2 mm. wide; stigma sessile or nearly so; seeds oblong, plump, essentially wingless, 1 mm. broad, biseriate.—Bull. So. Calif. Acad. Sci. **31:** 62 (1932) and Man. So. Calif. Bot. 203 (1935).—Utah, Nevada and California. Utah: Dutch Mountain, Tooele Co., June, 1900, *Jones 6169* (P). Nevada: Millin Mt., Esmeralda Co., May, 1884, *W. H. Shockley 366* (G, type; ND, US, isotypes). California: dry canyon, north slope of the San Bernardino Mts., May, 1882, *S. B. & W. E. Parish 1302* (G, DS).

The type of *A. Shockleyi* was cited by Watson[1] under *A. Beckwithii* when that species was originally published. However, he had included two distinct species in *A. Beckwithii* and it remained for Munz to separate them correctly and give one a new name. The three cited collections of *A. Shockleyi* come from widely separated points in the Great Basin and Mohave Desert region. In spite of this, the plants are remarkably uniform and undoubtedly belong to the same species. The paucity of material of *A. Shockleyi* emphasizes the fact that many of the desert mountain-ranges where it presumably occurs have not been adequately explored. In many cases they have not even been visited by a botanist.

42. A. **inyoensis,** sp. nov. Herba perennis; caulibus paucis erectis robustis rigidis inferne pubescentibus superne glabratis 2–5 dm. altis; foliis radicalibus numerosis lineari-oblanceolatis

[1] Proc. Am. Acad. **22:** 467 (1887).

vel spathulatis integris canescentibus 2–3 cm. longis, 2–5 mm. latis; foliis caulinis sessilibus oblongis auriculatis pubescentibus 1–2.5 cm. longis, 1.5–3 mm. latis; sepalis lineari-oblongis non saccatis pubescentibus 3.5–4.5 mm. longis; petalis roseis vel purpureis lingulatis vel spathulatis 7–9 mm. longis, ca. 2 mm. latis; pedicellis fructiferis divaricatis sparse pubescentibus vel glabris 6–12 mm. longis; siliquis glabris divaricatis 4–6 cm. longis, ca. 2 mm. latis; seminibus orbicularibus alatis ca. 1.5 mm. latis uniseriatis; cotyledonibus accumbentibus.

Deep-rooted perennial; stems several from an enlarged branching caudex, erect, rigid, densely pubescent below, glabrate above, 2–5 dm. high; basal leaves numerous, linear-oblanceolate to spatulate, acute, entire, densely pubescent with dendritic trichomes, gray, 2–3 cm. long, 2–5 mm. wide, petiolate; cauline leaves sessile, oblong, auriculate, densely pubescent, gray, only slightly overlapping, 1–2.5 cm. long, 1.5–3 mm. wide; flowering pedicels ascending, sparsely pubescent; sepals linear-oblong, non-saccate, pubescent, 3.5–4.5 mm. long; petals pink to purplish, lingulate to spatulate, 7–9 mm. long, about 2 mm. wide; glandular tissue weakly developed, continuous beneath all stamens; fruiting pedicels spreading at right angles to rachis, glabrous to sparsely pubescent, 6–12 mm. long; siliques glabrous, spreading at right angles to rachis or slightly descending, nerved at base or up to the middle, straight or nearly so, 4–6 cm. long, about 2 mm. broad; seeds orbicular, winged, about 1.5 mm. broad, uniseriate, wing about 0.3 mm. wide; cotyledons accumbent.—California: hills west of Big Pine, Inyo Co., May 15, 1906, *Heller 8259* (G, type; M, NY, UC, US, isotypes); Darwin, April 28, 1897, *M. E. Jones s.n.* (P); Ralston, Sierra Nevada, July 22, 1920, *H. M. Evans s.n.* in part (P); mountain slope west of Heart Lake, Rock Creek Lake Basin, Inyo Co., Aug., 1940, *Peirson 12975* (G, R); Shepherd Canyon, April 30, 1897, *M. E. Jones s.n.* (P); Hanaupah Canyon, Panamint Mts., Inyo Co., May, 1932, *Munz 12559* (P); Keeler, Inyo Co., April 14—, *T. S. Brandegee s.n.* (G).

Arabis inyoensis is somewhat related to *A. lignifera*, but differs, among other ways, in having broader, straight instead of curved siliques, more rigid stems and more widely winged seeds. Our species also bears some relation to *A. pulchra* with which it agrees in type of pubescence. *A. inyoensis* may be distinguished from the latter species by its auriculate cauline leaves, uniseriate seeds and widely spreading, glabrous siliques. In habit, *A. inyoensis* somewhat resembles *A. dispar*, but the seeds, siliques and type of pubescence are wholly different in

the two. *A. inyoensis* borders the Mohave Desert in east-central California.

43. A. PULCHRA M. E. Jones ex Watson. Perennial with a sub-shrubby base; caudex simple or branching, usually elevated above ground; stems one to several, simple or branched, densely pubescent with minute appressed dendritic trichomes throughout to glabrous above, 2–6 dm. high; basal leaves linear, entire or rarely slightly dentate, obtuse, densely pubescent with minute dendritic trichomes, petiolate, 4–8 cm. long, 3–6 mm. broad; cauline leaves linear, sessile, densely pubescent, non-auriculate, 2–6 cm. long, 3–4 mm. broad; pedicels erect or divergent at anthesis, sharply recurved to pendulous in fruit, densely pubescent (glabrous or nearly so in var. *gracilis*), 8–20 mm. long; sepals oblong, densely pubescent, often purplish, 5–8 mm. long, 1.5–2.5 mm. wide, outer pair very slightly saccate; petals purple to reddish or white, broadly spatulate, 8–20 mm. long, 3–5 mm. wide; glands well developed, continuous beneath all stamens; siliques strictly reflexed to pendulous, straight, densely pubescent (glabrous or nearly so in var. *gracilis*), hoary when young, 4–7 cm. long, 2.5–3.5 mm. wide; valves thick, nerved to the middle or above; stigma sessile or the style very short; seeds nearly orbicular, rather prominently winged, 1.5–2 mm. broad, biseriate.

KEY TO THE VARIETIES OF A. PULCHRA

a. Mature siliques strictly appressed on geniculately reflexed pedicels, densely pubescent; petals purple...........43a. var. *typica*.
a. Mature siliques pendulous on arched pedicels, densely pubescent to glabrous; petals purple to white...........*b*.
  b. Siliques and upper stems glabrous or nearly so; pedicels glabrous to very sparsely pubescent, slender, 1–2 cm. long..43d. var. *gracilis*.
  b. Siliques and upper stems densely pubescent; pedicels densely pubescent, stouter, 5–15 mm. long...........*c*.
    c. Petals purple, less than 1 cm. long. Western Utah, Nevada and California....................43b. var. *munciensis*.
    c. Petals white or rarely purple, 12–20 cm. long. Colorado and eastern Utah, southward....................43c. var. *pallens*.

43a. Var. **typica.** *A. pulchra* M. E. Jones ex Watson in Proc. Am. Acad. **22:** 468 (1887); Coville in Contrib. U. S. Nat. Herb. **4:** 61 (1893); Watson in Gray, Syn. Fl. N. Am. **1:** 167 (1895); M. E. Jones, Contrib. West. Bot. **14:** 41 (1912); Rydberg, Fl. Rky. Mts. 360 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Jepson, Man. Fl. Pl. Calif. 431 (1925) and Fl. Calif. **2:** 69 (1936); Munz, Man. So. Calif. Bot. 205 (1935); Jaeger, Desert Wild Fls. 79, fig. 167 (1940).—Nevada and California to Baja California, Mexico. MAP 23. NEVADA: Empire City, Ormsby Co., June 19, 1882, *M. E. Jones 3765* (G,

type; Cl, NY, P, US, isotypes); Carson City, Ormsby Co., June, 1897, *M. E. Jones s.n.* (P); Reno, Washoe Co., June 12, 1894, *Hillman s.n.* (P); 1 mile east of Virginia City, May, 1937, *Moore & Franklin 26* (R); pass west of Lida, Esmeralda Co., June, 1919, *Tidestrom 9846* (US). California: above Lake Sabrina at head of Bishop Creek, Inyo Co., Aug., 1938, *Constance 2465* (R); Lone Pine, Inyo Co., May, 1897 & May, 1927, *M. E. Jones s.n.* (P); 18 miles south of Ryan, Inyo Co., April, 1928, *Peirson 7807* in part (Peirs); Willow Springs, Kern Co., April, 1926, *Munz 10033* (P); Frazier Borax Mine, Ventura Co., June, 1908, *Abrams & McGregor 202* (G, NY, US); 4 miles southwest of Fairmont, Los Angeles Co., April, 1932, *Wheeler 569* (G); near Palmdale, Los Angeles Co., April, 1937, *Eastwood & Howell 3968* (G); Whitewater, Riverside Co., April, 1880, *Parish Bros. 97* (G); Hesperia, San Bernardino Co., April, 1917, *Spencer 391* (G, P, US); near Jacumba, San Diego Co., May, 1903, *Abrams 3643* (G, NY, P). Mexico: 50 miles southeast of Tecate, Baja California, May, 1925, *Munz 9560* (P).

43b. Var. muncIensis M. E. Jones. Pedicels gently spreading downward, never geniculately reflexed; siliques pendulous.—Contrib. West. Bot. **14:** 42 (1912).—Western Utah to eastern California. Map 23. Utah: between St. George and Beaver Dam Mts., May, 1919, *Tidestrom 9319* (US); Milford, May, 1903, *S. G. Stokes s.n.* (US). Nevada: Muncy, White Pine Co., May 19, 1906, *M. E. Jones s.n.* (P, type), June 25, 1906, *M. E. Jones s.n.* (P); Ferguson Spring, White Pine Co., June, 1900, *M. E. Jones s.n.* (P); Tonopah, April, 1907, *M. E. Jones s.n.* (P); Candelaria, Mineral Co., May—, *Shockley 218* (G); first canyon north of Pioche, Ely Range, Lincoln Co., April, 1939, *Train 2653* (G, NA, R). California: Darwin, April, 1897, *M. E. Jones s.n.* (P).

43c. Var. pallens M. E. Jones. Petals white or rarely purple, 1.2–2 cm. long, 4–5 mm. wide at apex; pedicels arching downward or rarely more strictly reflexed; siliques pendulous.—Contrib. West. Bot. **14:** 42 (1912). *A. formosa* Greene, Pitt. **4:** 198 (1900); Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909); Wooton & Standley in Contrib. U. S. Nat. Herb. **19:** 280 (1915); Rydberg, Fl. Rky. Mts. 360 (1918).—Western Colorado, eastern Utah and adjacent Arizona and New Mexico. Map 23. Colorado: 2 miles west of Rifle, Garfield Co., May, 1938, *Rollins 2201* (G, R); 8 miles west of Grand Junction, May, 1938, *Rollins 2169* (G, R); Grand Junction, May, 1892, *Eastwood s.n.* (G, US); near Westwater, Utah, but in Mesa Co., Colo., May 6, 1891, *M. E. Jones s.n.* (P, type; G, NY, US, isotypes); Naturita, April, 1914, *Payson 245* (G, Ph, RM); 6 miles east of Montrose, Montrose Co., May, 1938, *Rollins 2120*

(G, R). New Mexico: Aztec, April, 1899, *C. F. Baker 345* (US, type; G, NY, RM, isotypes of *A. formosa*). Utah: 8 miles south of Manila, Daggett Co., June, 1938, *Rollins 2281* (G, R); 14 miles west of Vernal, Uintah Co., June, 1937, *Rollins 1748* (G, R); San Rafael Swell, Emery Co., May, 1914, *M. E. Jones s.n.* (P); Lower Crossing (Woodside), Emery Co., July, 1898, *M. E. Jones s.n.* (P); La Sal Mts., June, 1913, *M. E. Jones s.n.* (P); Cisco, May, 1890, *M. E. Jones s.n.* (P, US); near Bluff, San Juan Co., April, 1936, *Maguire 13518* (R). Arizona: vicinity of Kayenta, 1922, *Wetherill s.n.* (NY).

43d. Var. gracilis M. E. Jones. Pubescence coarser and less dense than in var. *typica;* stems glabrous above; pedicels arched downward, never geniculately reflexed, slender, 1–2 cm. long; siliques pendulous, glabrous or nearly so.—Contrib. West. Bot. **8:** 41 (1898); Munz, Man. So. Calif. Bot. 205 (1935). *A. trichopoda* Greene in Fedde, Rep. Nov. Sp. **5:** 242 (1908), not *A. trichopoda* Turcz. in Bull. Mosc. **8:** 63 (1840). *A. pulchra* Jones, var. *glabrescens* Wiggins in Contrib. Dudl. Herb. **1:** 100 (1929). *A. pulchra* Jones, var. *viridis* Jepson, Fl. Calif. **2:** 70 (1936).—Nevada and California. Map 19. Nevada: Calientes, Lincoln Co., April, 1904, *M. E. Jones s.n.* (NY, P); Meadow Valley Wash, April, 1904, *M. E. Jones s.n.* (P); Goodsprings, Clark Co., May, 1905, *M. E. Jones s.n.* (P). California: Silver Canyon, east of Laws, Inyo Co., May, 1906, *Heller 8191* (G); Dantes Point, Inyo Co., April, 1928, *Munz & Hitchcock 11014* (P); Shepherd Canyon, Argus Mts., May 1, 1897, *M. E. Jones s.n.* (P, type; US, isotype; also type and isotype of *A. trichopoda*); Granite Well, above Cooper City, May, 1922, *Johnston 6552* (P, RM); Providence Mts., May, 1920, *Munz et al. 4263* (P); Cactus Flat, San Bernardino Mts., May, 1926, *M. E. Jones s.n.* (P); Cima Road, 10 miles south of Las Vegas Road, April, 1930, *Peirson 8733* (Peirs); Jacumba-Mountain Springs, April, 1920, *Eastwood 9541* (G); Jacumba, April, 1924, *Eggleston 19773* (G, P); Julian-Banner, March, 1926, *Wiggins 2015* (G, P, US, isotypes of *A. pulchra*, var. *glabrescens*).

That *A. pulchra* is made up of a series of several varieties was first recognized by Jones, l. c., who studied the species as he explored much of the arid area it occupies. His three varieties, which have a measure of geographical discreteness, are accepted as probably representing natural subdivisions of the species. The very densely pubescent siliques and biseriate seeds will easily identify all plants of *A. pulchra,* except var. *gracilis,* which has nearly glabrous siliques and pedicels. *A. pulchra* is a weak-stemmed plant with a sub-shrubby base. It is very

often found tangled among desert shrubs from which it derives support. The very large-flowered var. *pallens* usually has white flowers, but sometimes purple flowers are also found. The latter variety was named *A. formosa* by Greene, but the plants certainly do not represent a distinct species.

Jepson[1] states that Jones "first recognized and named this species and indicated (in herb.) as the type his specimens (Jones 3764) from Empire City, Ormsby Co., Nev. June 19, 1882". These data are correct except that the type is *Jones, no. 3765* in the Gray Herbarium, the specimen from which the original description was drafted by Watson. Two sheets of this number are in the Jones Herbarium at Pomona College. Fortunately, *Jones 3764* is not the type because three of the four sheets bearing that number which I have examined are *A. sparsiflora*, var. *typica*, the fourth is a mixture of the latter plant and *A. pulchra*.

44. A. TRICORNUTA Rollins. Perennial; stems single, branched above, pubescent below with simple or branched trichomes, glabrous above, 3–6 dm. high; basal leaves caducous, unknown; lower cauline leaves petiolate, oblanceolate, pubescent with harsh 2- or usually 3-pronged trichomes, 3–5 cm. long, about 1 cm. wide; upper cauline leaves linear to narrowly lanceolate, glabrous; inflorescence lax, slender, greatly elongated; sepals glabrous, nearly ovate to broadly oblong, 3–4 mm. long, 2–3 mm. wide, unequal, non-saccate, inner pair tapering at base; petals white, narrowly spatulate, thickened toward base with edges rolled outward, erose to entire along upper margin, not strongly differentiated into blade and claw, 4–5 mm. long, about 1.5 mm. wide; stamens slightly shorter than petals, filaments of single stamens curved, filaments of paired stamens straight; glandular tissue surrounding base of single stamens, continuous beneath paired stamens, well developed; pedicels slender, gently curved downward, glabrous, 1–1.5 cm. long; siliques glabrous, 1-nerved to middle or above, spreading at right angles to widely pendulous, often secund, 3–7 cm. long, about 2 mm. wide; style about 1 mm. long; stigma entire; seeds flat, orbicular, conspicuously winged all around, about 1.5 mm. broad, uniseriate; cotyledons obliquely accumbent.—In Kearney and Peebles in Journ. Wash. Acad. Sci. **29:** 478 (1939).—ARIZONA: Eastview, Rincon Mts., Oct. 13, 1909, *J. C. Blumer 3478* (G, TYPE); Rincon Mts., 1891, *Neally 120* in part (US); Santa Rita Mts., Aug. 23, 1936, *Darrow & Arnold s.n.* (G).

[1] Fl. Calif. **2:** 70 (1936).

Arabis tricornuta is particularly interesting because at anthesis it is very difficult to distinguish from *Thelypodium micranthum.* In habit, inflorescence, flower and type of pubescence they are almost identical. One minor feature of flower-similarity is particularly striking. In both species the short stamens arise at right angles to the ovary and then curve upward. This particular characteristic has not been observed in other species of *Arabis*, but it is not of major importance as a diagnostic character, since there is considerable variation in stamen-insertion throughout the genus. The definitely winged seeds, accumbent cotyledons and markedly flattened siliques of *A. tricornuta* leave little doubt about its being properly placed in *Arabis,* in spite of the striking similarity it shows to another species of a different genus. *A. tricornuta* is not closely related to any North American species of *Arabis,* but the flower, inflorescence, and upper parts of the plant are similar to *A. laevigata.* It is somewhat like *A. repanda,* particularly as regards the petiolate cauline leaves, but the similarity is only superficial. *A. tricornuta* is apparently restricted to the mountains of southern Arizona where it has been collected at elevations of between seven and nine thousand feet.

45. A. REPANDA Watson. Perennial; caudex simple or branched; pubescence of forked or dendritic trichomes; stems one to few, branched above, densely pubescent below, sparsely pubescent to glabrous above, green to purplish, (1–) 2–7 dm. high; basal leaves rosulate, petiolate, deeply toothed, repand or entire, densely pubescent, oblanceolate to broadly spatulate, obtuse, 3–7 cm. long, 1–3 cm. wide, petiole winged; cauline leaves petiolate or the upper sessile, broadly oblanceolate to nearly linear, densely pubescent, often subtending the somewhat flexuous branches, 1–6 cm. long, 0.5–2 cm. wide, entire to repand; inflorescences rather lax, terminating the stem-branches; pedicels stout, straight, divaricately ascending to erect, pubescent to rarely glabrous, 3–6 (–10) mm. long; sepals pubescent, linear-oblong, 4–5 (–6) mm. long, 1–2 mm. wide, non-saccate, outer pair slightly longer than the inner; petals white to pinkish, nearly linear, narrow at base, 4–6 mm. long, about 1 mm. wide; all stamens nearly equal in length; nectar-glands weakly developed, nearly surrounding all stamens; siliques divaricately ascending, straight or often falcate, pubescent to glabrous, linear, coriaceous, nerved to the middle or usually nerveless, 4–10 cm.

long, 2–4 mm. wide; style slender, 1 mm. or less long; seeds orbicular to slightly elliptical, widely winged, 2–4 mm. broad including wings; cotyledons accumbent.

45a. Var. **typica.** *A. repanda* Watson in Proc. Am. Acad. **11:** 122 (1875); Brewer & Watson, Bot. Calif. **1:** 32 (1876); Coville in Contrib. U. S. Nat. Herb. **4:** 61 (1893); Watson in Gray, Syn. Fl. N. Am. **1:** 161 (1895); Jepson, Man. Fl. Pl. Calif. 429 (1925) and Fl. Calif. **2:** 63 (1936).—Nevada and California. Map 10. Nevada: 8 miles southwest of Reno, Sierra Nevada, Washoe Co., June, 1938, *Archer 6111* (G, NA, R), July, 1938, *Archer 6259* (NA, R); 10 miles southwest of Carson City, Douglas Co., June, 1938, *Archer 6032* (NA). California: west of Alder Springs, Glenn Co., July, 1917, *Heller 12799*) Cl, G, M, NY, US); near Floriston, Nevada Co., June, 1934, *J. T. Howell 11836* (G); Stanislaus Forest, Alpine Co., July, 1913, *Eggleston 9573* (US); Bridgeport Quadrangle, Eagle Creek, Mono Co., July, 1937, *Hendrix 329* (VTM); Yosemite Valley, Mariposa Co., 1866, *H. N. Bolander 4881* (G, type); above Whiskey Creek, 1 mile below Ellis Meadow, Madera Co., July, 1938, *Constance 2386* (R); Giant Forest, Tulare Co., July, 1905, *T. S. Brandegee s.n.* (NY); near Mineral King, Tulare Co., July, 1891, *Coville & Funston 1389* (G, US); Tehachapi, Kern Co., June, 1889, *E. L. Greene s.n.* (US); Frazier Mt., Ventura Co., July, 1905, *Hall 6614* (UC); North Baldy Mt., Los Angeles Co., July, 1908, *Abrams & McGregor 589* (G, US); Bear Valley, San Bernardino Mts., San Bernardino Co., June, 1895, *S. B. Parish 3752* (G, UC, US), Aug., 1902, *Abrams 2863* (G, NY, P, US); North Fork Tahquitz Creek, San Jacinto Mts., Riverside Co., Sept., 1922, *Munz 6386* (P).

45b. Var. Greenei Jepson. Stems 1–3.5 dm. high; leaves entire to slightly dentate; pedicels sparsely pubescent, 5–10 mm. long; siliques glabrous, 2–2.5 mm. wide, nerved at least to the middle; style about 1 mm. long; seeds about 2 mm. broad including wings.—Fl. Calif. **2:** 63 (1936). *A. inamoena* Greene, Leaflets **2:** 158 (1911), not *A. inamoena* Greene in Fedde, Repert. Nov. Sp. **5:** 243 (1908).—Map 10. California: 19 miles south of Mono Lake, Mono Co., Aug., 1938, *Constance 2461* (R); South Lake, Inyo Co., July, 1913, *Davidson 2956* (G); Lake Sabrina, Bishop Creek, Inyo Co., July 11—, *Davidson 2729* (ND, type); Rock Creek Lake Basin, west of Heart Lake, Inyo Co., Aug., 1933, *Peirson 10768* (P, Peirs).

Plants of *A. repanda* have been collected at various altitudes ranging from 5,000 to 11,500 ft., but they appear to be most abundant in the pine belt. A dwarfed variety of the species was named *A. inamoena* by Greene, l. c., the name being a

homonym of his own earlier *A. inamoena* which in turn is synonymous with *A. platysperma*. Jepson, l. c., renamed the later *A. inamoena* of Greene as *A. repanda*, var. *Greenei*, stating that it "is at most of varietal value". The variety *Greenei* is based on its small size, entire or nearly entire leaves and usually longer style than that found in var. *typica*. None of these features is completely consistent in the four collections examined. The siliques of var. *Greenei* are nerved below, glabrous, and the seeds are less widely winged than those of var. *typica*.

There is some variation in the amount of vestiture on different plants of var. *typica*. The type, together with a number of other collections, has pubescent siliques, but in the majority of specimens of *A. repanda* studied the siliques are glabrous. There is evidence that mature siliques are sometimes glabrous only because the indument has been shed. Other species of *Arabis*, such as *A. pulchra* and *A. puberula*, are known to shed the indument from their siliques and the phenomenon is in line with the general evidence regarding the unreliability of the presence or absence of vestiture as a criterion in the genus.

46. A. GLAUCOVALVULA M. E. Jones. Perennial; stems one or several from a ligneous, branching caudex, fairly robust, simple or branching above, hoary throughout, 1.5–4 dm. high; basal leaves linear to slightly broader, entire, obtuse, densely pubescent with dendritic trichomes, hoary, 2–5 cm. long, 2–5 mm. wide; cauline leaves lanceolate to linear-lanceolate, sessile, non-auriculate, densely pubescent throughout, 1–4 cm. long, 2–5 mm. broad; sepals oblong, reddish, non-saccate, pubescent, 4–5 mm. long, 2 mm. broad; petals with an oblong blade which is narrowed to a slender claw, pink to whitish, 6–8 mm. long, about 2 mm. wide; nectar-glands developed under single stamens, nearly obsolete under the paired stamens; pedicels stout, strongly recurved, densely pubescent; siliques reflexed, oblong, obtuse at both ends, glabrous and glaucous, one-nerved to the middle or often the entire length, 2–4.5 cm. long, 5–8 mm. wide; style evident, less than 1 mm. long; seeds orbicular, very widely winged, 5–6 mm. broad including the wings, biseriate.—Contrib. West. Bot. **8:** 40 (1898); Jepson, Man. Fl. Pl. Calif. 432, fig. 419 (1925) and Fl. Calif. **2:** 71 (1936); Munz, Man. So. Calif. Bot. 205 (1935); Jaeger, Desert Wild Fls. 82, fig. 170 (1940).—California and Nevada. MAP 18. CALIFORNIA: Keane Spring, Inyo Co., May, 1932, *Munz 12577* (P); Darwin Mesa, Argus Mts., May 8, 1897, *M. E. Jones s.n.* (P, TYPE; M, NY, Ph, RM,

UAC, UC, US, isotypes); 2 miles west of Darwin, May, 1932, *Munz 12489* (M, P, UC); Black Mts., Death Valley, May 2, 1927, *E. C. Jaeger s.n.* (P); Bishop Creek, Inyo Co., May, 1906, *Hall & Chandler 7246* (M, UC); 10 miles southeast of Windmill Tank, April, 1932, *C. L. Hitchcock 12241* (P); 3 miles east of Warren's Well, San Bernardino Co., May, 1922, *Munz & Johnston 5179* (Cl, G, NY, RM); Lanfair Valley, eastern San Bernardino Co., May, 1935, *Munz 13704* (P); Cottonwood Springs, Riverside Co., May, 1905, *Hall 6019* (UC), April, 1932, *C. L. Hitchcock 12241* (P); White Tanks, eastern Riverside Co., April, 1932, *Munz & Hitchcock 12231* (M, P); Keyes Ranch, Little San Bernardino Mts., May, 1922, *Munz & Johnston 5251* (Cl, UC, US).

Arabis glaucovalvula is one of the most distinctive species in the genus and has a very restricted range, bordering the Mohave Desert in California and Nevada. I have not seen specimens from Nevada, but a single collection is reported from that state by Jepson, l. c. The linear basal leaves, moderately fine dendritic pubescence, non-auriculate cauline leaves and biseriate seeds seem to relate this species to *A. pulchra*, while the broad siliques and large and widely winged seeds indicate something of an affinity with *A. platysperma* and *A. suffrutescens*. Actually, *A. glaucovalvula* is not closely allied to any other known species.

47. A. dispar M. E. Jones. Perennial; stems several from a branching, lignescent caudex, simple or branched above the base, densely pubescent below, less so above, 1–2.5 dm. high; basal leaves numerous, entire, erect, spatulate to linear-oblanceolate, slender-petioled, hoary with a dense, fine, dendritic pubescence, 1.5–2.5 cm. long, 2–4 mm. broad; cauline leaves sessile, broadly linear, reduced upwards, hoary, 1–2 cm. long, 1.5–2 mm. broad; sepals oblong, pubescent, purplish with scarious margins, about 4 mm. long, 1.5 mm. wide; petals obovate, purplish, not differentiated into blade and claw, 5–6 mm. long, about 2 mm. wide at apex; pedicels nearly erect to divaricate, pubescent, 1–2 cm. long; siliques divaricate to more ascending, glabrous, acute, 5–7 cm. long, 2.5–3.5 mm. wide, mid-nerve prominent below, absent above the middle; stigma sessile to subsessile; seeds nearly orbicular, widely winged, about 2 mm. broad, imperfectly uniseriate.—Contrib. West. Bot. **8:** 41 (1898); Munz, Man. So. Calif. Bot. 203 (1935); Jepson, Fl. Calif. **2:** 71 (1936). *A. nardina* Greene, Leaflets **2:** 70 (1910); Jepson, l. c. *A. salubris* Jones, Contrib. West. Bot. **14:** 37 (1912). *A. juniperina* Jones,

Contrib. West. Bot. **15:** 68 (1929).—MAP 17. CALIFORNIA: Pleasant Canyon, Panamint Mts., Inyo Co., May 6, 1897, *M. E. Jones s.n.* (P, TYPE; M, UAC, US, isotypes); north fork of Hanaupah Canyon, Panamint Mts., May, 1932, *Munz 12569* (P); Mill Canyon, Panamint Mts., May, 1891, *Coville & Funston 776* (US, TYPE; G, isotype of *A. nardina*); near Bishop, Inyo Co., May 13, 1927, *M. E. Jones s.n.* (P); Cactus Flat in Cushenbury Canyon, May 13, 1927, *M. E. Jones s.n.* (P, TYPE of *A. juniperina*); north slope of the San Bernardino Mts., San Bernardino Co., May, 1892, *S. B. & W. F. Parish 1300* (G); Quail Springs, Little San Bernardino Mts., May, 1922, *Munz & Johnston 5214* (Cl, G, P, RM).

The types of *A. dispar* and *A. nardina* are almost identical in every way except for the slightly narrower siliques on that of *A. nardina*. This difference is certainly not of sufficient definitive importance to warrant the maintenance of two names for an otherwise homogeneous entity. The type of *A. juniperina* is a slightly larger plant than the average and the siliques are a trifle more ascending than is usually found in *A. dispar*, but these are only minor variations to be expected as a response to local environmental conditions. *A. dispar* is most closely related to *A. Johnstonii,* but is separated from it on a number of fundamental points stressed in a discussion under that species.

I was not able to find a type for *A. salubris* at the Pomona College Herbarium. Jones's citation of the type-specimen is nearly identical with that for the type of *A. dispar*. From the descriptions it seems almost certain that he described the same collection under two different names, *A. dispar* in 1898 and *A. salubris* in 1912.

48. A. JOHNSTONII Munz. Perennial, densely pubescent with fine dendritic trichomes; stems several from a ligneous, branching caudex, erect or ascending, simple to branched, pubescent throughout, 1–2 dm. high; basal leaves entire, linear-oblanceolate to narrowly spatulate, petioled, 1–2 cm. long, 1.5–3.5 mm. wide, hoary with a fine dense dendritic pubescence; cauline leaves entire, sessile, not auriculate, lanceolate to linear-oblong, hoary, 1–1.5 cm. long, 2–5 mm. wide; sepals purplish, oblong, pubescent, 4.5–6 mm. long, about 1.5 mm. wide, outer pair slightly saccate at base; petals purple, spatulate, 8–10 mm. long, 2–3 mm. wide; ovary glabrous; pedicels ascending, pubescent, 6–10 mm. long; siliques very shortly stipitate, erect, glabrous, one-nerved to the middle or above, 3–5 cm. long, 2–3 mm. wide,

apex acuminate; style slender, persistent, 1–2 mm. long; seeds nearly orbicular, widely winged, about 1.5 mm. broad, uniseriate.—In Bull. So. Calif. Acad. Sci. **31:** 63 (1932) and Man. So. Calif. Bot. 204 (1935).—Southern CALIFORNIA: Riverside Co.: Kenworthy, San Jacinto Mts., May 19, 1922, *Munz & Johnston 5485* (P, type; G, isotype), May, 1937, *Munz 15123* (G, P); near Toro Mt., San Jacinto Reserve, March, 1898, *Leiberg 3173* (US); Hemet Valley, San Jacinto Mts., *Peirson 3030* (Peirs).

A. Johnstonii is related to *A. dispar*, but is readily distinguished by its more ascending, shorter siliques, short gynophore, slender persistent style, larger purple petals and slightly saccate outer sepals. In general appearance, specimens of *A. Johnstonii* look like "grown-up" plants of *A. Parishii.* These species are related, but are easily separated on a number of characters. The flower is smaller and the style much shorter, yet the siliques are much larger in *A. Johnstonii* than in *A. Parishii.* The latter species has small, very narrowly winged seeds instead of the large, broad-winged seed which is characteristic of *A. Johnstonii.* At present the known range of *A. Johnstonii* is limited to a single mountain-system, the San Jacinto Mts. of southern California.

49. A. PARISHII Watson. Perennial; stems several to numerous and tufted from a subterranean branching caudex, slender, simple, densely pubescent with dendritic trichomes below, less so upward, 3–14 cm. high; basal leaves numerous, entire, narrowly linear-oblanceolate, tapering to a short petiole, acute, hoary with a fine dendritic pubescence, 5–15 mm. long, 1–2 mm. wide; cauline leaves few, sessile, entire, not petioled nor auricled, hoary, linear, 5–10 mm. long, 1–2 mm. wide; sepals oblong, green or purplish, pubescent, 3–4 mm. long; petals purple, bluish or rarely almost white, spatulate, tapering to a very narrow claw, 8–13 mm. long; pedicels erect to slightly spreading, rather stout, pubescent, 3–7 mm. long; siliques ascending, glabrous, nerved to the middle or above, 1–2 cm. long, 2–3 mm. wide, acuminate; style filiform, 4–8 mm. long; seeds elliptical to nearly orbicular, narrowly winged, 1–1.5 mm. broad, imperfectly uniseriate.—Proc. Am. Acad. **22:** 468 (1887) and in Gray, Syn. Fl. **1:** 167 (1895); Jepson, Man. Fl. Pl. Calif. 433 (1925) and Fl. Calif. **2:** 72 (1936); Munz, Man. So. Calif. Bot. 203, fig. 101 (1935).—San Bernardino County, CALIFORNIA: Bear Valley, San Bernardino Mts., June, 1886, *Parish 1793* (G, TYPE; UC, isotype), June, 1895, *Parish 3751* (G, UC, US), June, 1922, *Munz 5751* (G); near Baldwin Lake, San Bernardino Mts., June,

1924, *Munz 8179* (G, NY); Sugarloaf Mt., San Bernardino Mts., July, 1906, *Hall 7537* (M, RM, UC); June, 1922, *Peirson 3101* (G, Peirs, RM).

Arabis Parishii is distinctive in habit, character of the style and localization of range. The specific circumscription is clear, yet its relationship to *A. Johnstonii* and *A. dispar* is unmistakable. It is found, chiefly in exposed places, from the upper canyon-slopes to the higher peaks and ridges of the San Bernardino Mountains in southern California. The species could be usefully introduced into cultivation as a rock-garden plant of exquisite beauty.

50. A. SUFFRUTESCENS Watson. Suffruticose perennial; stems several to many from a widely branching caudex, simple or rarely branched above, glabrous (pubescent below in var. *horizontalis*), (1–) 2–5 dm. high; basal leaves linear to oblanceolate or sometimes nearly spatulate, acute to obtuse, glabrous or rarely sparsely pubescent (densely pubescent in var. *horizontalis*), 1–4 cm. long, 2–6 mm. wide; cauline leaves few, sessile, auriculate (non-auriculate in var. *perstylosa*), lanceolate to narrowly obovate, acute or the lower obtuse, glabrous or rarely with a few marginal trichomes, 1–3 cm. long, 2–6 mm. wide; flowers few; sepals oblong to slightly broader, glabrous, 3.5–4.5 mm. long; petals spatulate, rose to purplish, 6–8 mm. long, 2.5–3 mm. wide; pedicels slender, glabrous, horizontal to strictly reflexed, 4–10 mm. long; siliques pendulous to strictly reflexed (horizontal in var. *horizontalis*), glabrous, one-nerved from base to above middle or often to the tip, acuminate, 4–7 cm. long, 3–6 mm. wide, venation evident; style less than 1 mm. long or absent (2–3.5 mm. long in var. *perstylosa*); seeds orbicular, widely winged, 2–3.5 mm. wide including wings, imperfectly uniseriate, papery wings about 1 mm. wide; cotyledons accumbent.

KEY TO THE VARIETIES OF A. SUFFRUTESCENS

Styles less than 1 mm. long or absent; cauline leaves auriculate; siliques horizontal to strictly reflexed.
- Siliques pendulous to strictly reflexed; plants 2–5 dm. high; basal leaves and lower stems glabrous or nearly so....50a. var. *typica*.
- Siliques horizontally spreading; plants 1–2 dm. high; basal leaves and lower stems densely pubescent.......50b. var. *horizontalis*.

Styles 2–3.5 mm. long; cauline leaves non-auriculate; siliques strictly reflexed..............................50c. var. *perstylosa*.

50a. Var. **typica.** *A. suffrutescens* Watson in Proc. Am. Acad. **17:** 362 (1882) and in Gray, Syn. Fl. N. Am. **1:** 166 (1895); Howell, Fl. Northw. Am. **1:** 45 (1897); Piper in Contrib. U. S.

Nat. Herb. **11**: 295 (1906); Rydberg, Fl. Rky. Mts. 360 (1918); Jepson, Man. Fl. Pl. Calif. 432 (1925) and Fl. Calif. **2**: 70 (1936); Rollins in Res. Stud. State Coll. Wash. **4**: 48, fig. 15 (1936). *A. duriuscula* Greene, Pitt. **4**: 191 (1900). *A. dianthifolia* Greene, Leaflets **2**: 76 (1910).—Idaho to California and Washington. Map 19. Idaho: ridge west of Cascade, Valley Co., July, 1937, *Thompson 13852* (G, R); Payette National Forest, Aug., 1912, *Martineau & Sparhawk 59* (FS); Rush Creek, Washington Co., July, 1899, *Jones 6164* (NY, RM, UC, US); near Bonanza, Custer Co., July, 1916, *Macbride & Payson 3481* (G, NY, RM); near Martin, Blaine Co., July, 1916, *Macbride & Payson 3070* (G, NY, RM, US), June, 1938, *C. L. Hitchcock 3826* (R); above Galena, Blaine Co., July, 1895, *Henderson 3537* (US). California: Medicine Lake, Siskiyou Co., July, 1921, *Eastwood 10885* (G, US); Shackleford Creek, Siskiyou Co., July, 1910, *Butler 1705* (RM, UC, US); Salmon-Trinity Alps, Caribou Basin, Siskiyou Co., July, 1937, *J. T. Howell 13379* (G, R); Lassen Forest, Lassen Co., July, 1933, *Fischer & Johnson F273* (UC); 1000 Lake Basin, Shasta Co., July, 1932, *Peirson 10151* (Peirs, UC); Donner Lake, Nevada Co., July, 1893, *Michener s.n.* (ND, type of *A. duriuscula;* photo in Gray Herb.); Truckee, Nevada Co., June, 1892, *Sonne 9* (NY, UC); Mt. Lola, Nevada Co., July, 1903, *Hall & Babcock 4539* (UC); Kaiser Crest, Fresno Co., July, 1914, *Smiley 621* (G). Oregon: mouth of Battle Cr., Wallowa Co., July, 1933, *Peck 17616* (NY, W); bluffs of Snake River and vicinity, Baker Co., 1881, *W. C. Cusick 919* (G, type); stony hills near Snake River, Baker Co.?, May, 1898, *Cusick 1898* (G, UC, US, WSC); Steens Mts., Harney Co., July, 1896, *Leiberg 2514* (G, NY, O, US); Santiam Nat. Forest, Linn Co., 1920, *Ingram 1360* (OS); near Paulina Lake, Deschutes Co., June, 1931, *J. T. Howell 7097* (G), July, 1920, *Peck 9685* (G, NY, T, W); Crater Lake, Klamath Co., Sept. 14, 1902, *Coville 1511* (US, type of *A. dianthifolia*), July, 1928, *Wynd 2250* (O); near Buck Lake, Jackson Co., July, 1936, *Thompson 13121* (T). Washington: Wenaha River Trail, Columbia Co., July, 1913, *Darlington s.n.* (WSC); Cleman Mt., Yakima Co., June, 1892, *Henderson 2398* (UW); Mt. Adams, probably Yakima Co., Aug., 1885, *Suksdorf 511* (G), May, 1884, *Suksdorf 633* (UC, US, WSC), Aug. 15, 1882, *T. Howell s.n.* (O, T, US).

50b. Var. horizontalis (Greene) Rollins. Stems numerous, slender, 1–2 dm. high, pubescent below; basal leaves pubescent with dendritic trichomes; cauline leaves nearly ovate to oblong, pubescent or the upper glabrous; pedicels 4–8 mm. long, glabrous, horizontally spreading; siliques horizontal, 2–4 cm. long, 2.5–4 mm. wide.—Res. Stud. State Coll. Wash. **4**: 50 (1936);

Applegate in Am. Midl. Natur. **22:** 269 (1939). *A. horizontalis* Greene, Leaflets **2:** 74 (1910).—Southern OREGON: Crater Lake, Klamath Co., Aug. 1, 1897, *Coville & Applegate 334* (US, TYPE; RM, isotype), July, 1929, *Wynd 1545 & 1547* (O); Llao Rock, Crater Lake, July, 1924, *Hall 11972* (DS); Mt. Garfield, July, 1918, *Heller 13040* (G, NY, US).

50c. Var. **perstylosa,** var. nov. Herba glabra; foliis caulinis sessilibus, non auriculatis; stylis filiformibus 2–3.5 mm. longis. Plants glabrous or very rarely with a few trichomes along the margins of the basal leaves; stems one to several or many; cauline leaves remote, sessile, non-auriculate; siliques strongly nerved; style persistent, slender, 2–3.5 mm. long.—MAP 19. CALIFORNIA: open bare serpentine slope, above Middle Fork of the Feather River, 7.3 miles southeast of Quincy, Plumas County, June 9, 1938, *Lincoln Constance 2309* (G, TYPE; R, isotype).

There is considerable variation in the width of the siliques in *A. suffrutescens.* On the average, plants from Washington, eastern Oregon and Idaho seem to have slightly broader siliques than those from southern Oregon and California, but this is only a tendency and the species could not be divided, using silique-width as a basis. Var. *typica* is usually glabrous throughout, but specimens with branched trichomes along the basal leaf-margins or even on the blade-surfaces are occasionally found. The leaves are ordinarily fairly narrow and acute, although plants in which the lower cauline and basal leaves are broad and obtuse are sometimes collected. Neither *A. dianthifolia* Greene nor *A. duriuscula* Greene have characteristics which serve to separate them from *A. suffrutescens.* They do not even represent end points of normal trends in specific variation.

Variety *horizontalis* is distinguished from var. *typica* by its lower stature, more numerous, slender stems, shorter pedicels, horizontally spreading, smaller siliques and rather densely pubescent basal leaves. The plants are quite distinctive in appearance. However, they possess the basic characteristics of *A. suffrutescens* and must be included in the species as a whole. The variety is known from several stations, all within Crater Lake National Park.

Known only from the single collection cited, var. *perstylosa* is distinguished from var. *typica* by its long style and non-auriculate cauline leaves. Var. *typica* often has a sessile stigma or the style may reach a millimeter in length, but in var.

perstylosa, the style is never less than 2 mm. long and is usually about 3 mm. in length. Ordinarily, species of *Arabis* vary in the length of the style, and, were it not for the fact that this character is associated with the lack of auricles on the cauline leaves, one might suggest that var. *perstylosa* is only a marked variant of var. *typica.* These rather marked characteristics associated together are sufficient, it seems to me, to warrant making the separation.

51. A. platysperma Gray. Perennial, pubescence dendritic; stems several to numerous from a simple or branching caudex, erect to somewhat decumbent, simple or often branched above, pubescent to glabrous, (0.5–) 1–4 dm. high; basal leaves numerous, oblanceolate or narrower, acute to obtuse, rather densely pubescent to glabrous, entire, 2–5 cm. long, 3–8 mm. wide; cauline leaves few, remote, oblong to linear-lanceolate, sessile, not auriculate (except occasionally in var. *Howellii*), pubescent or glabrous, 1–1.5 cm. long, 2–5 mm. wide; sepals oblong, non-saccate, pubescent or glabrous, 3–4 (–5) mm. long; petals pink to white, spatulate, 4–6 (–7) mm. long, 2–3 mm. wide; glandular tissue continuous beneath all stamens, often surrounding single stamens; pedicels divaricately ascending, straight, pubescent or glabrous, 5–15 mm. long; siliques erect to divaricately ascending, straight, broad, flat, acuminate, 3–7 cm. long, 3–5 mm. wide; valves distinctly veined, nerved toward the base; style less than 1 mm. long or absent; seeds orbicular, widely winged, 3–4 mm. broad including the wings, uniseriate; cotyledons accumbent.

51a. Var. **typica.** Basal leaves, lower stems and sepals pubescent; stems 1–4 dm. high; cauline leaves never auriculate; sepals 3–4 mm. long; petals 4–6 mm. long; stems very often branching above.—*A. platysperma* Gray in Proc. Am. Acad. **6:** 519 (1865); Watson in King, Geol. Expl. Fortieth Parallel **5:** 16 (1871); Brewer & Watson, Bot. Calif. **1:** 32 (1876); Coville in Contrib. U. S. Nat. Herb. **4:** 61 (1893); Watson in Gray, Syn. Fl. N. Am. **1:** 163 (1895); Howell, Fl. Northw. Am. **1:** 45 (1897) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 243 (1925); Jepson, Man. Fl. Pl. Calif. 432, fig. 420 (1925) and Fl. Calif. **2:** 71, fig. 138 (1936) in part; Munz, Man. So. Calif. Bot. 204 (1935); Rollins in Res. Stud. State Coll. Wash. **4:** 47, fig. 14 (1936) in part. *Erysimum platyspermum* (Gray) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891). *A. inamoena* Greene in Fedde, Rep. Nov. Sp. **5:** 243 (1908), not *A. inamoena* Greene, Leaflets **2:** 158 (1911). *A. oligantha* Greene in Fedde, Rep. Nov. Sp. **5:** 243 (1908).—Nevada, California and Oregon.—Map 25. Nevada: Sierra Nevada above Virginia City, Ormsby Co.,

July, 1939, *Train 3251* (NA, R); near Mt. Rose, Aug., 1938, *J. T. Howell 14060* (G); 20 miles southwest of Reno, June, 1937, *Henrichs s.n.* (G); along Galena Creek, 7 miles west of Reno Hot Springs, Washoe Co., July, 1937, *Archer 5667* (R); divide south of Slide Mt., Washoe Co., July, 1913, *Heller 10932a* (G, NY, UC, US); East Humboldt Mts., Sept., 1868, *Watson 69* (G, NY, US). CALIFORNIA: Half Moon Meadow, Marble Mt. Primitive Area, Siskiyou Co., Aug., 1939, *S. K. & C. C. Harris 6039* (G, R); Mt. Shasta, Siskiyou Co., Sept., 1897, *Canby 16* (G), 1860–62, *Brewer 1393* (G, US); headwaters of Hat Creek, Shasta Co., July–Aug., 1911, *Eggleston 7433* (G, NY, US); Diamond Mt., Lassen Co., June, 1897, *M. E. Jones s.n.* (NY, UC); near Jonesville, Butte Co., July, 1917, *Heller 12859* (G, US), June, 1931, *Copeland 643* (NY, RM, UC); Soda Springs, Nevada Co., July, 1881, *M. E. Jones 2512* (NY, UAC, UC, US); Donner Pass, Placer Co., July, 1903, *Heller 6975* (G, NY, RM, UC, US); Echo Camp, Eldorado Co., Aug., 1915, *Heller 12176* (G, NY); Ebbetts Pass, Alpine Co., 1863, *Brewer 1989* (G, TYPE; UC, US, isotypes); Cloud's Rest-Moraine Dome, Yosemite National Park, July, 1936, *Helen Sharsmith 3809* (G, R); Belle Meadow, Tuolumne Co., July, 1934, *Wiggins 6898* (G); near Devil's Postpile, Madera Co., Aug., 1938, *J. T. Howell 14469* (G, R); Long Meadow, Tulare Co., June 7–12, 1888, *E. Palmer 192* (US, TYPE; NY, isotype of *A. inamoena*); 0.2 mile east of Sonora Pass, Mono Co., Aug., 1938, *Constance 2449* (R); region of Dinkey Creek, Fresno Co., June–July, 1900, *Hall & Chandler 354* (US, TYPE; NY, UC, isotypes of *A. oligantha*); Baldy Mt. (Mt. San Antonio), San Bernardino Co., Aug., 1880, *Parish Bros. 498* (G); Dollar Lake, San Bernardino Mts., Aug., 1922, *Munz 6241* (G, RM); San Jacinto Mts., San Bernardino Co., June, 1921, *Jaeger 577* (US); Tahquitz Ridge, San Jacinto Mts., July, 1908, *Reed 2527* (UC). OREGON: Mt. Scott, Klamath Co., *Thompson 12290* (G, NY).

51b. Var. HOWELLII (Watson) Jepson. Entire plant glabrous or rarely with a few trichomes along the petiole of the basal leaves, often dwarfed at high altitudes; stems 0.5–3 dm. high; sepals glabrous, 3–5 mm. long; petals obtuse, 5–7 mm. long; cauline leaves sometimes auriculate.—Man. Fl. Pl. Calif. 432 (1925). *A. Howellii* Watson in Proc. Am. Acad. **25:** 124 (1889) and in Gray, Syn. Fl. N. Am. **1:** 167 (1895); Howell, Fl. Northw. Am. **1:** 45 (1897). *A. platyloba* Greene in Pitt. **4:** 198 (1900); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 243 (1925). *A. platysperma* sensu Howell, Fl. Northw. Am. **1:** 45 (1897) in part; Rollins in Res. Stud. State Coll. Wash. **4:** 46 (1936) in part. *A. chionophila* Greene ex C. F. Baker, West Am. Pl. [1] 16 (1902). *A. conferta* Greene in Fedde, Rep. Nov. Sp. **5:** 243

(1908). *A. Covillei* Greene, ibid. *A. Leibergii* Greene, ibid. *A. platysperma* Gray, var. *imparata* Jepson, Fl. Calif. **2:** 72 (1936). *A. inamoena* Greene, var. *acutata* Jepson, ibid.—Nevada, California and Oregon. Map 24. Nevada: divide south of Slide Mt., Washoe Co., July, 1913, *Heller 10932* (G, NY, UC, US); Marlette Lake, Washoe Co., July, 1902, *Baker 1389* (G, UC, US); Mt. Rose, Washoe Co., July, 1937, *Breene 523* (NA, R); Snow Valley, Ormsby Co., June, 1912, *Baker 1157* (ND; photo in Gray Herb. This specimen was labeled *A. chionophila* by Greene and is the basis for *A. chionophila* Greene ex Baker, West. Am. Pl. [1] 16 (1902), nomen nudum). California: Caribou Basin, Salmon-Trinity Alps, Siskiyou Co., July, 1937, *J. T. Howell 13444* (G, R); Devil's Canyon Mts., Trinity Co., *Tracy 14712* (R, UC); Mt. Shasta, Aug., 1882, *Pringle 18* (G); Lake Solfatara, Lassens Peak, Shasta Co., 1896, *Mrs. R. M. Austin s.n.* (ND, type; US, isotype of *A. platyloba;* photo of type in Gray Herb. This collection is also the basis for *A. platysperma* Gray, var. *imparata* Jepson); Benson Pass, northern part of Yosemite Nat. Park, Aug., 1936, *Helen Sharsmith 3810* (G, R); Conness Trail, near Young's Lake, Tuolumne Co., July, 1937, *Peirson 7610* (Peirs, type of *A. inamoena*, var. *acutata*); Ragged Peak, Tuolumne Co., July, 1936, *Mason 11264* (G); terminal moraine of Conness Glacier, Mono Co., July, 1936, *Mason 11425* (G); Taboose Pass, Inyo Co., *Peirson 2535* (Peirs); near Mineral King, Tulare Co., Aug., 1891, *Coville & Funston 1492* (US, type; G, NY, isotypes of *A. Covillei*); mountain near Little Kern River, April–Sept., 1897, *Purpus 5231* (US, type; G, UC, isotypes of *A. conferta*). Oregon: Mt. Hood, Hood River Co., Sept., 1880, *J. & T. J. Howell 309* (G, US); Mt. Jefferson, Jefferson Co., Aug., 1919, *J. C. Nelson 2881* (G); west slope of Middle Sister, Lane Co., July, 1914, *Peck 2720* (G); Paulina Peak, Deschutes Co., June, 1931, *J. T. Howell 7053* (G); north of Mt. Bachelor, Deschutes Co., July, 1931, *J. T. Howell 7129* (G); Crater Lake, Klamath Co., Aug., 1916, *Heller 12633* (G, NY, OS, US); Mt. Thielson, Klamath Co., Aug., 1897, *Coville & Applegate 436* (US); Gayhart Buttes (Gearhart Mt.) Aug., 1896, *Coville & Leiberg 262* (US, type of *A. Leibergii*); Ashland Butte, Jackson Co., July 19, 1887, *T. Howell 664* (G, type; OS, Ph, T, US, isotypes), July, 1935, *Thompson 12333* (G); near Oregon Caves, Josephine Co., July, 1918, *Peck 8330* (G, W).

Arabis platysperma varies rather widely in height and in the size and shape of its foliar organs. At high altitudes the plants are apt to be considerably dwarfed, with numerous stems less than 1 dm. high. Conversely, at lower altitudes, particu-

larly in favorable sites, the stems may reach 4 dm. in height. These variations apparently accompany differing conditions of habitat and are only rarely correlated with slight dimensional differences observable in such conservative organs as the flower. In spite of the variation in habit, the flowers and fruits remain fairly constant throughout.

The two points noted by Greene as justifying the segregation of *A. inamoena*, "pubescent sepals and very short colorless petals", are both perfectly characteristic of typical *A. platysperma*. The very short colorless petals are found when the flower first opens, later the petals elongate and often become pink- or purplish-tipped. I cannot see anything in the type-specimen of *A. oligantha* which differs particularly from the type of *A. platysperma*.

It has been with some hesitation that the pubescent and glabrous phases of *A. platysperma* have been separated. I do not believe the two varieties are natural, even though var. *Howellii* does have a more northerly range and is usually found at higher altitudes than var. *typica*. So far as I have been able to determine, the glabrous condition is not correlated with any constant character such as width or shape of the siliques, as suggested by Jepson, l. c. At the very highest altitudes, var. *Howellii* becomes exceedingly dwarfed and in the northern part of its range the flowers tend to be slightly larger than in the southern. In general the same series of variations run through var. *Howellii* as are found in var. *typica*.

An interesting repetition occurred when Jepson, l. c., proposed var. *imparata* for the glabrous, broad-podded phase of *A. platysperma*. This variety was based on a collection by Mrs. R. M. Austin from Lake Solfatara, Lassens Peak, California, which Greene, l. c., earlier used as the basis for his *A. platyloba*. The plants of this collection are glabrous and the siliques are very wide, but there is nothing fundamentally distinctive about them. In the present treatment they are placed with the glabrous, usually more dwarfed var. *Howellii*. *A. inamoena*, var. *acutata* is an extremely dwarfed form of var. *Howellii* with rather narrow basal leaves. The siliques are markedly acute, due largely to their immaturity, but this is not a singular character in the species.

52. A. **pygmaea,** sp. nov. Herba perennis; caudicibus simplicibus vel ramosis foliis emortuis persistentibus tectis; caulibus tenuibus erectis simplicibus inferne pubescentibus superne glabratis vel pubescentibus 5–10 cm. altis; foliis radicalibus integris linearibus hispidulis 1–2 cm. longis, 1–2 mm. latis, pilis furcatis vel simplicibus; foliis caulinis paucis remotis linearibus sessilibus non auriculatis hispidulis 5–10 mm. longis, 1–2 mm. latis; sepalis pubescentibus ca. 2 mm. longis; petalis albis?; pedicellis adscendentibus sparse pubescentibus 5–8 mm. longis; siliquis erectis acuminatis glabris 2–4 cm. longis, 4–5 mm. latis; stigmatibus sessilibus; seminibus orbicularibus alatis 2.5–3.5 mm. latis; cotyledonibus accumbentibus.

Perennial, caudex simple or branched, usually covered with a series of hemispherical clusters of dead leaves; stems several, slender, erect to slightly decumbent, simple, rather densely pubescent below with forked trichomes, sparsely pubescent above or glabrate, 5–10 cm. high; basal leaves tufted, entire, narrowly linear, hispid with coarse forked trichomes, marginal trichomes often simple and larger than those on the blade surfaces, 1–2 cm. long, 1–2 mm. wide; cauline leaves few, remote, sessile, non-auriculate, linear, loosely hispid, 5–10 mm. long, 1–2 mm. wide; sepals pubescent, about 2 mm. long; petals white?; pedicels ascending, sparingly pubescent, 5–8 mm. long; siliques erect, straight, somewhat acuminate, mid-nerve rather obscure, netted venation evident, glabrous, 2–4 cm. long, 4–5 mm. wide; stigma sessile; seeds orbicular, broadly winged, 2.5–3.5 mm. broad including wings; funiculi free, slender, 2–3 mm. long; cotyledons accumbent.—CALIFORNIA: Basin of the Upper Kern River, Volcano Meadows (originally known as Whitney Meadows), Tulare Co., July 21, 1904, *H. M. Hall & H. D. Babcock 5465* (G, TYPE; M, NY, OS, US, isotypes); Olancha Mt., Tulare Co., June, 1904, *Hall & Babcock 5465* (RM; the collection bears the same number as the above, but it is marked with a different locality and date); Moraine Lake to Big Arroyo, headwaters of the Kern River, July, 1916, *M. L. Campbell s.n.* (Calif. Acad. Sci.).

This species is evidently the one described under *A. inamoena* Greene by Jepson,[1] though I have not seen any of the collections cited. *A. inamoena*, var. *acutata* of the same publication is *A. platysperma*, var. *Howellii.* As shown by the type-specimen, *A. inamoena* Greene (1908) is nothing more than typical *A. platysperma.* The statement in Greene's description, "caulibus tenuibus 1–1.5 cm. altis", has possibly been responsible for the misapplication of the name *A. inamoena* to the plants here

[1] Fl. Calif. 2: 72 (1936).

A. PYGMAEA drawn from *Hall & Chandler 5465*. About one and one-half times natural size.

named *A. pygmaea.* It is probable that "cm." in the above quotation is a misprint for "dm.", since both the type at the U. S. National Herbarium and an isotype at the New York Botanical Garden show the stems to be 1–2 dm. high. *A. pygmaea* is related to *A. platysperma,* the siliques and seeds of each being almost identical. The significant differences between the two are found in the foliage, pubescence and habit of growth. Definitive statements concerning these characters are given in the key.

53. A. PETIOLARIS Gray. Annual or biennial ?; single stem simple below, robust, usually branched above, pilose at base, becoming glabrous upward, 4–10 dm. high; basal leaves long-petioled, lyrate to pinnately lobed, pilose on both surfaces, 1–1.5 dm. long, 2–6 cm. wide; cauline leaves long-petioled, lower similar to the basal, pilose to glabrate; upper reduced, entire to rarely dissected, lanceolate, glabrous; sepals oblong, glabrous, 3–5 mm. long, 1–1.5 mm. wide; petals pink, spatulate, 6–8 mm. long, 1.5–2 mm. wide; filaments often attached to petals at base; glandular tissue weakly developed, continuous under all stamens; pedicels glabrous, divaricately ascending, straight, 8–12 mm. long; siliques flattened, broad, acuminate, straight, divaricately ascending, 4–8 cm. long, 3–4 mm. wide; style slender, 1–2 mm. long; seeds orbicular, widely winged all around, 3–4 mm. broad including the wings, uniseriate.—Proc. Am. Acad. **6:** 187 (1863); Coulter in Contrib. U. S. Nat. Herb. **2:** 19 (1891); Watson in Gray, Syn. Fl. N. Am. **1:** 161 (1895); Cory & Parks in Texas Agric. Exp. Sta. Bull. **550:** 48 (1938). *Streptanthus petiolaris* Gray in Mem. Am. Acad. **4:** 7 (1849). *S. brazoensis* Buckley in Proc. Acad. Sci. Phila. 448 (1861). *Erysimum petiolare* (Gray) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891).—Central TEXAS: rocky hill, Austin, Travis Co., May, 1872, *E. Hall 17* (G, NY, US); Barton Creek Valley, near Austin, April, 1918, *Young 24* (G); San Marcos Spring, Hays Co.?, 1847, *C. Wright s.n.* (G, TYPE); San Marcos, Hays Co., April, 1917, *Palmer 11562* (RM); Coleman County, April, 1882, *Reverchon 4* (G); Makewater Creek, Coleman Co., April, 1882, *Reverchon 1246* (US); Bear Mountain, Gillespie Co., May, 1935, *Cory 12875* (G); San Saba, San Saba Co., May, 1917, *Palmer 11797* (RM); New Braunfels, Comal Co., May, 1851, *Lindheimer 517 & 674* (G), May, 1850, *Lindheimer 675* (G, NY); western Texas to El Paso, May–October, 1849, *Wright 5* (G); San Antonio, Bexar Co., *M. E. Jones 798* (P); Bexar County, June, 1904, *Jermy s.n.* (NY).

Arabis petiolaris is different from all other American species of *Arabis* in having strongly petiolate, somewhat dissected cauline leaves. *A. tricornuta* and *A. repanda* have petiolate cauline leaves, but they are not dissected, nor is the petiole strongly developed. In some respects *A. petiolaris* resembles certain members of the genus *Sibara*, but in the aggregate its characters are those of an *Arabis*. O. E. Schulz[1] has placed this species in a separate section of *Arabis* § *Oxytria*. That *A. petiolaris* is a very distinctive species of *Arabis* is unquestioned, but I cannot agree with Schulz that it is the only *Arabis*-species which has apiculate anthers. A number of American species, including *A. crucisetosa*, *A. furcata*, *A. blepharophylla*, *A. aculeolata* and several others, have this character very plainly marked.

Species Excluded from Arabis or with Names of Uncertain Application

1. *A. Bolanderi* Watson in Proc. Am. Acad. **22:** 467 (1887)[2] was based upon plants with sterile siliques.

2. *A. Brebneriana* A. Nelson in Bull. Torr. Bot. Club **25:** 373 (1898) = *Halimolobos virgatus* (Nuttall) O. E. Schulz in Engler, Pflanzenr. **4:** fam. 105, 290 (1924).

3. *A. Bourgovii* Rydberg in Mem. N. Y. Bot. Gard. **1:** 186 (1900), based on *Turritis patula* Graham. See footnote under *Arabis patula* (Graham) Torrey below.

4. *A. elata* Piper in Proc. Biol. Soc. Wash. **37:** 91–92 (1924). The type of this species in the U. S. National Herbarium has sterile siliques and is otherwise deformed. It is believed that normal plants would be referable to one of the varieties of *A. sparsiflora* Nuttall.

5. *A. Endlichii* O. E. Schulz in Notizbl. **11:** 390 (1932) = *Sibara Viereckii* (Schulz) Rollins, var. **Endlichii** (Schulz), comb. nov.

6. *A. filifolia* Greene in Bull. Calif. Acad. Sci. **2:** 390 (1887) = *Sibara filifolia* Greene in Pittonia **3:** 11 (1896).

[1] Engler's Bot. Jahrb. **66:** 94 (1933).

[2] When Watson described *A. Bolanderi*, he cited three specimens as follows, "Yosemite or Mono Pass (Bolander); mountains of Washington Territory (Brandegee); also collected by Dr. Torrey, a more glabrous form, probably in the mountains of California, but ticketed in his herbarium as from Colorado." These specimens have one thing in common. They all bear sterile siliques. Otherwise, they probably belong to three separate species, but the presence of nothing but aborted ovules, sterile siliques and the attendant effects of sterility on the plants, makes their identification difficult. I have not been able to place confidently Bolander's specimen, the type of *A. Bolanderi*, with any California species of *Arabis*, but it appears to belong with one of the varieties of *A. Holboellii*. The Brandegee specimen from Washington is almost certainly a variety of *A. sparsiflora* Nuttall, but the Torrey specimen is too fragmentary to be placed at all. I suggest the name *A. Bolanderi* be discarded on the grounds that it is of uncertain application to living plants; it was based on three discordant elements (the specimens probably belong to three separate species), and its type is a near-monstrosity.

7. *A. hastatula* Greene, Leaflets **2:** 79 (1910). The type in the U. S. National Herbarium is a flowering specimen not certainly determinable, but I believe it should be referred to *A. Holboellii,* var. *retrofracta* (Grah.) Rydb.

8. *A. Holboellii* Hornem., var. *patula* (Grah.) Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895), based on *Turritis patula* Graham. See footnote below under *Arabis patula* (Graham) Torrey.

9. *A. Hookeri* Lange, Consp. Fl. Groen. **3:** 50 (1880) = *Halimolobos* **mollis**[1] (Hooker) comb. nov., based on *Turritis mollis* Hooker, Fl. Bor.-Am. **1:** 40 (1829).

10. *A. longirostris* Watson in King, Geol. Expl. Fortieth Parallel **5:** 17, pl. 1 (1871) = *Streptanthella longirostris* (Watson) Rydberg, Fl. Rky. Mts. 364 (1918).

11. *A. Menziesii* (Hook.) A. Nelson in Proc. Biol. Soc. Wash. **18:** 187 (1905) = *Phoenicaulis cheiranthoides* Nuttall in T. & G. Fl. N. Am. **1:** 89 (1838).

12. *A. Menziesii lanuginosa* Nelson & Macbride in Bot. Gaz. **55:** 374 (1913) = *Phoenicaulis cheiranthoides,* var. **lanuginosa** (Watson), comb. nov., based on *Parrya Menziesii,* var. *lanuginosa* Wats. in Gray, Syn. Fl. N. Am. **1:** 152 (1895).

13. *A. Menziesii,* var. *lata* Nelson & Macbride, l. c. = *Phoenicaulis cheiranthoides* Nutt.

14. *A. mexicana* Watson in Proc. Am. Acad. **17:** 319 (1882) = *Sibara* **mexicana,** comb. nov.

15. *A. patula* (Graham) Torrey, Bot. U. S. & Mex. Bound. Surv. **1:** 32 (1859), based on *Turritis patula*[2] Graham in Edinb. New Phil. Journ. 350 (1829); not *Arabis patula* Host, Fl. Austr. 271 (1831).

16. *A. pectinata* Greene, Pittonia **1:** 287 (1889) = *Sibara pectinata* Greene, Pittonia **3:** 11 (1896).

[1] This species is very closely related to *Halimolobos virgatus* of the Rocky Mountain area. It is interesting to note that Hooker originally compared it to the Mexican and South American *Turritis hispidula* which is now also included in *Halimolobos.*

[2] *Turritis patula* has not been identified with any modern species of *Arabis,* although the description is full and it is certain that the plant described is an *Arabis.* Apparently no type was preserved at Edinburgh (see Hopkins in RHODORA **39:** 134) and it has been impossible to determine which of several Rocky Mountain species of *Arabis* should bear the name. I am inclined to think the name should be associated with one of the varieties of *A. sparsiflora,* but Hopkins, l. c., thought the description could be applied to plants of *A. divaricarpa.* My own notion on the matter is supported to some extent by a specimen of *A. sparsiflora,* var.? in the Torrey Herbarium of the New York Botanical Garden marked "Franklin's Journey Dr. Hooker" with the fruiting portion marked "cultivated." Both annotations are presumably in the handwriting of Asa Gray. Does this specimen represent part of the garden material from which Graham drew his description of *Turritis patula?* In so far as the specific name *patula* is concerned, the identity of Graham's plant is not important because the same specific epithet was used in *Arabis* several times before Torrey made the transfer based on Graham's name. However, two species have been proposed using *Turritis patula* Graham as their basinym, and it is with them that we must deal. *Turritis Grahamii* Lehmann in Litt.-Bericht zur Linnaea für das Jahr 1831, p. 74, is the oldest substitute name I know about and it antedates the names in current use. Also *Arabis Bourgovii* Rydberg in Mem. N. Y. Bot. Gard. **1:** 186 (1900) is a substitute name for *Turritis patula* Graham, therefore resting on the same type. At present it is impossible to assign the names based on Graham's description to any species of *Arabis.* If a type is discovered, then this will be possible.

17. *A. pedicellata* A. Nelson in Proc. Biol. Soc. Wash. **17:** 91 (1904) = *Phoenicaulis cheiranthoides*, var. *lanuginosa* (Watson) Rollins.
18. *A. runcinata* Watson in Proc. Am. Acad. **17:** 319 (1882) = *Sibara* **runcinata,** comb. nov. (Not *A. runcinata* Lam., Encycl. **1:** 222 (1783).
19. *A. Viereckii* O. E. Schulz in Notizbl. **11:** 389 (1932) = *Sibara* **Viereckii** (Schulz), comb. nov.
20. *A. virginica* (L.) Poir. Encycl. Suppl. **1:** 413 (1810) = *Sibara* **virginica** (L.), comb. nov., based on *Cardamine virginica* L., Sp. Pl. **2:** 656 (1753).
21. *A. Whitedii* Piper in Bull. Torr. Bot. Club **28:** 39 (1901) = *Halimolobos* **Whitedii** (Piper), comb. nov.

Stanford University.

VIBURNUM EDULE AND ITS NOMENCLATURE

M. L. Fernald

Viburnum edule (Michx.) Raf. in Med. Repos. hex. 2, v. 354 (1808); Pursh, Fl. Am. Sept. i. 203 (1814), in part only. *V. Opulus*, γ. *edule* Michx. Fl. Bor.-Am. i. 180 (1803). *V. Opulus pauciflorum* Raf. Alsog. Am. 58 (1838). *V. pauciflorum* La Pylaie ex Torr. & Gray, Fl. N. Am. ii. 17 (1841). *V. Opulus*, var. *eradiatum* Oakes in Hovey's Mag. vii. 183 (1841). *V. eradiatum* (Oakes) House in Am. Midl. Nat. vii. 130 (1921).

In its nomenclatural misinterpretations *Viburnum edule* well illustrates the failures to go to original sources which lead to so many errors in the names of our American plants. In § *Opulus* we have three species, two endemic Americans and the introduced Eurasian *V. Opulus*. Briefly their diagnostic characters are as follows.

Petioles exstipulate at base, glandless at summit or with small glands at base of leaf-tissue; blades shallowly lobed or unlobed; cymes 1.5–3.5 cm. broad, of uniform perfect flowers; stamens much shorter than corolla-lobes; straggling to erect shrub .... *V. edule.*
Petioles with slender basal stipules, usually with glands well below the leaf-tissue; blades deeply lobed; cymes 0.4–1.5 dm. broad, their marginal flowers neutral and with greatly enlarged flat corollas; stamens of perfect flowers longer than corolla-lobes; upright shrubs or small trees.
  Glands on petioles dome-shaped, columnar or clavate, with rounded summits; stipules filiform-clavate or with thickened tips .... *V. trilobum.*
  Glands on petioles forming depressed concave-topped disks; stipules filiform-attenuate, with slender tips .... *V. Opulus.*

Viburnum trilobum Marsh. is the American species which is often merged with the Eurasian *V. Opulus*. Michaux, Fl. Bor.-Am. i. 180 (1803) divided *V. Opulus* into three varieties:

Var. α. *europeanum.*
β. *Pimina:* foliis tricuspidatis; lobis sursum angustatis promisse acuminatis.
γ. *edule:* pumilum, strictum, multicaule foliis brevissime lobatis, denticulato-serratis, denticulis acuminatis; fructibus edulibus.
Hab. in Canada.

V. Opulus, β. Pimina (from colloquial name in Canada) is, of course, *V. trilobum, γ. edule,* not only by the clear description but by the specimen of it preserved in the Michaux herbarium at Paris, which I examined first in 1903, which is characteristic *V. pauciflorum* La Pylaie. This, as above indicated, was properly, but quite unintelligently, published by Rafinesque in 1808 as *V. edule,* lack of understanding where nomenclatural transfers and realignments are concerned often being glorified over clear understanding of the characters of the plants! Rafinesque (1808), forecasting a work never published, enumerated scores of *nomina nuda* but by associating some of his binomials with properly described plants of others he got by. In a group of new binomials based upon American plants of Michaux and including *Potamogeton epihydrus, P. foliosus* and others which are regularly taken up, Rafinesque had "Viburnum edulum [error for *edule*], V. opulus var. of *Mich.*" Rafinesque, by giving no description, merely rested his *V. edule* upon *V. Opulus,* var. *edule* Michx., which is *V. pauciflorum* La Pylaie ex Torr. & Gray (1841). Pursh, however, with as little understanding of the actual Michaux material as Rafinesque, boggled things, for he added to his description of *V. edule* (1814) the glandular petioles and neutral marginal flowers of *V. Opulus* and *V. trilobum* ("petiolis glandulosis, cymis radiatis"), although citing Michaux's variety as the source of the name. It thus followed, that, taking their conception of *V. edule,* not from the Michaux material, but from Pursh's misrepresentation of it, the name *V. edule* Raf. (not Pursh) has been regularly assigned to the synonymy either of *V. Opulus* or its American representative, *V. trilobum.*

Later, in 1838, Rafinesque got hold of material from Labrador of the small shrub, without stipules and petiolar glands (the only member of the section growing in Labrador) and gave a lucid account of it as *V. Opulus pauciflorum,* this trinomial being erroneously rendered in Index Kewensis as a binomial *V.* "*pauciflorum*

Rafin. Alsog. Am. 58"; and, most unfortunately, Rafinesque's trinomial has been accepted as a binomial by Robinson & Fernald and some others, instead of the properly published binomial *V. pauciflorum* La Pylaie ex Torr. & Gray (1841) or, as above shown, *V. edule* Raf. (1808).

House, making the combination *V. eradiatum* (Oakes) House (1921), supposed that there was a *V. pauciflorum* Raf. (1838), House's *V. eradiatum* being "*Viburnum pauciflorum* Pylaie; Torr. & Gray, Fl. N. Am. (2): 17. 1841. Not Raf. Alsog. Am. 58. 1838". Had House carefully compared the description in Torrey & Gray with that of Rafinesque (1838) he would have found that they both emphasized the most important characters: lack of stipules and usually of petiolar glands, slight lobing of blade, small cymes on lateral shoots, etc. Here is Rafinesque's account of 1838, from which it is clear that he did not know his own *V. edule* of 1808 but interpreted the latter from Pursh's inaccurate later description:

251. *Vib. Op. pauciflorum* Raf. ramulis teretis verrucosis, petiolis nudis sine gland. vel stipulis, fol. latovatis non trilobis, basi rotundatis vel subcord. serratis glabris; cymis pedunc. paucifl. vel trifloris, fruct. rubris subrot. compressis—apparently different from *V. edule* [as defined by Pursh] with glandular petiols and trilobe leaves. From Labrador, stem thick rubicund, with small white warts, many bifoliate lateral shoots.

Torrey & Gray's account of the La Pylaie plant (from Newfoundland) is so readily available that I merely quote phrases: "leaves . . . slightly 3-lobed or incised at summit . . .; petioles destitute of stipuliform appendages; cymes (small and simple) pedunculate, terminating the short lateral branches." That this account, in 1841, of the Squashberry of Newfoundland was based on specimens similar to those which Rafinesque described in 1838 is apparent. Unfortunately, the long-established name *V. pauciflorum,* accompanied in both cases by a clear diagnosis, has to give way to the technically correct, though by its author not understood name *V. edule* Raf. (1808).

A new Locality for Solidago Shortii.—*Solidago Shortii* T. & G. was described from specimens collected by Dr. C. W. Short in 1840 on Rock Island, an island at the Falls of the Ohio River at Louisville, Kentucky. So far as known, the species has not until recently been collected elsewhere.

In September, 1939, the writer discovered *Solidago Shortii* growing in abundance in a rather barren over-grazed hillside pasture in Nicholas County, Kentucky, not far from Blue Licks. This goldenrod attracted attention because it is shorter in stature and stiffer than other members of its group. Its rather rigid glabrous leaves also set it apart from related species. Specimens sent to the Gray Herbarium were compared with Short's material by Mr. Weatherby and Prof. Fernald who verify the determination.

The Blue Licks locality is one hundred miles in a straight line from the type locality. The species is abundant for a short distance north, south, and west of Blue Licks; it occurs in the three counties (Nicholas, Robertson and Fleming) which come together near Blue Licks. A question naturally arises concerning features which may be connected with the distribution of this local endemic species. The seeds of Solidago are well adapted to wind dispersal, yet this species is not generally distributed. Certainly there is nothing peculiar or unique in the Blue Licks habitat. In thinking of Rock Island and of Blue Licks, one cannot but conjecture as to the possibility that buffaloes played a part in the dispersal of seed. The Falls of the Ohio are known to have been one of the important crossings of the Ohio River used by countless hundreds of buffaloes. Blue Lick Springs was a focal point of several important buffalo traces. Buffaloes had the peculiar habit of "wallowing" in muddy places, especially about "licks" such as Blue Lick Springs; in this way they became coated with mud which could have contained many seeds. They are known to have traveled rapidly from place to place, often covering great distances. Seed accidentally picked up at either locality could easily have been transported to the other place.—E. Lucy Braun, University of Cincinnati, Cincinnati, Ohio.

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CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. CXXXIX

ANOTHER CENTURY OF ADDITIONS TO THE FLORA OF VIRGINIA[1]

M. L. Fernald

(Plates 670–695)

Part I. Journal of Field-trips in 1940

Ambitious to get into the field and glad temporarily to escape being forced to witness the occupation of the lap of spring by the New England winter, I induced Dr. Arthur Stanley Pease to join Mr. Bayard Long and me at our Virginia headquarters at Century House, south of Petersburg, for our brief spring recess. Although spring had not emerged in eastern Massachusetts, we basked in sunshine in southeastern Virginia, from March 30 to April 4, and tramped through woodlands full of *Nemophila microcalyx*,[2] gigantic *Hepatica americana* (DC.)

[1] Exploration done with aid from the Penrose Fund of the American Philosophical Society.

[2] In this, as in preceding papers of this series, the authors of species are omitted in the narrative if they are in Gray's Manual. The preceding papers on the work in Virginia are as follows: Fernald & Griscom, *Three Days of Botanizing in Southeastern Virginia*, Rhodora, xxxvii. 129–157 and 167 189, 20 plates (1935)—Contrib. Gray Herb. CVII; Fernald, *Midsummer Vascular Plants of Southeastern Virginia*, Rhodora, xxxvii. 378–413 and 423–554, 22 plates (1935)—Contrib. Gray Herb. no. CIX; Fernald, *Plants from the Outer Coastal Plain of Virginia*, Rhodora, xxxviii. 376–404 and 414–452, 13 plates (1936)—Contrib. Gray Herb. no. CXV; *Local Plants of the Inner Coastal Plain of Southeastern Virginia*, Rhodora, xxxix. 321–366, 379–415, 433–459 and 465–491, 14 plates (1937)—Contrib. Gray Herb. no. CXX; *Noteworthy Plants of Southeastern Virginia*, Rhodora, xl. 364–424, 434–459 and 467–485, 27 plates (1938)—Contrib. Gray Herb. no. CXXIII; *Last Survivors in the Flora of Tidewater Virginia*, Rhodora, xli. 465–502, 529–559 and 564–577, with 14 plates (1939)—Contrib. Gray Herb. no. CXXVIII; *A Century of Additions to the Flora of Virginia*, Rhodora, xlii. 355–416, 419–498 and 503–521, with 24 plates (1940)—Contrib. Gray Herb. no. CXXXIII.

Ker. in three color-forms, *Corydalis flavula,* which we had not previously seen on the Coastal Plain, *Dentaria laciniata* (sometimes 18 inches high), and more limited colonies of *Obolaria* or of *Aplectrum,* the latter with distinctively veined over-wintering leaves and last year's fruiting stems up to 20 inches high. Little of novelty was seen, though in one piece of new seeding the apetalous *Lamium amplexicaule,* forma *clandestinum* (Reichenb.) G. Beck, replaced the common plant with expanded purplish corollas; and one fallow field was given over to masses of *Viola arvensis* in perplexing color-variations and mingled with *Veronica hederaefolia,* which we had not previously noted in the state. A new station for *Galax aphylla* on the Coastal Plain was found and additional ones for *Symplocarpus foetidus* and for *Caltha palustris,* each of them indicating areas needing exploration (not yet made) later in the season. *Amelanchier* was flowering; and one species which we had collected in previous years seemed very marked by its broadly oblong to oblong-obovate leaves, corymbiform racemes and erect calyx-lobes. This proves to be *A. austromontana* Ashe, described from the Carolina mountains and, I believe, not recorded from Virginia.

When we were forced to return to our regular duties at home spring in Virginia was rapidly advancing; but it was more than a month before Long and I could get back to Petersburg for another period of exploration (May 6–12). As on the April trip and for some years past we were happy in securing the assistance of Mr. Leonard Birdsall and his car—happy because we always enjoy Leonard's companionship, sane common sense, good humor and ready helpfulness, and the ability of the car, under his guidance, to go into the most improbable places.

The early species of *Carex* were maturing and we promptly took under consideration the perplexing plant which we had repeatedly collected, overripe, in June and July, on bottomlands of the Nottoway. Strongly resembling the wide-ranging *C. grisea* and *C. amphibola* Steud., this plant of the lower Nottoway has puzzled us since 1936 because its inflated perigynia have a puckered and crumpled summit. In the past we had wondered if it were wholly normal, but now it was superabundant on the rich calcareous bottoms wherever we visited the Nottoway (as Pease has aptly said, it is one of many species of southeastern

Virginia there found "not away from the Nottoway"), its healthy deep green foliage and the inflorescences all vigorous and normal but with the perigynia regularly with the crumpling so long noted in dead-ripe material. Examination shows that, whereas the two closely similar species, *C. grisea* and *C. amphibola,* have the prolonged achenes tapering at summit and essentially filling the perigynia, our puzzling plant has them only half as long and with truncate summits. This fundamental character of the achene, which accounts for the extreme puckering of the empty summit of the perigynium, was abundantly checked in much ripe material in June, also in the old collections in the herbarium, and again in June of the current year. The plant is a morphologically quite distinct and undescribed species, to be further considered and illustrated (PLATE 671) in Part II. That started the genus *Carex* with a high initial score; but on four of our trips of 1940 we added 10 other members of the genus (2 never before known from north of Georgia, others unknown from south of northern Maryland and 1 undescribed) to the known flora of Virginia!

While Pease was with us in early April we had, inevitably, taken him to the extensive sandy pine barrens which follow the eastern bank of the Blackwater from below South Quay Bridge into northwestern Gates County, North Carolina. Nothing but *Pyxidanthera* and *Carices* were yet flowering there but the splendid association of rare evergreen shrubs is always alluring and there is always the hope of a new discovery. In early April, finding that the bridge at South Quay was being replaced and, consequently, not open to travel, we sought a new and short route back to Franklin, rather than go far out of our way by following the surfaced roads. So we took a dirt road northward from Duck's Store and very soon found ourselves skirting the eastern margin of a fine new tract of white sand and pine barren (characterized by Long-leaf Pine and Catesby's Oak) in Isle of Wight County, south of Lee's Mill and midway between that south of Zuni and the similar but larger area in Nansemond County. In just this chance way we had discovered in 1936 the pine barren between Zuni and Walters; very similarly, we had unexpectedly happened upon the extensive pine barren of western Nansemond; and now we had a third such tract

awaiting exploration—discovered at twilight on our last day of the April trip. Early May was too soon to expect much, but the preliminary canvass showed the typical carpets of *Pyxidanthera* and of *Vaccinium crassifolium* Andr., which meant that day after day until late autumn must be devoted to the new barrens.

In April we had found the rich slopes by the James near Indian Point a carpet of *Corydalis flavula* and other species of rich woods. So, returning there in May, we were promptly rewarded by a second station in the state for *Carex Jamesii* and a good colony of *C. Leavenworthii*, new to Virginia (afterward found along the Appomattox at Petersburg, and under the oaks at Benns Church in Surry County). *Ranunculus micranthus* was here more than 1½ feet high; *Viola striata*, at our only Coastal Plain station, was in full bloom; and *Myosotis macrosperma* Engelm. was unusually tall (up to 2¾ feet high). The latter species (MAP 1)[1] has been very generally misunderstood. It is frequently confounded with merely overgrown *M. verna* Nutt. (*M. virginica* sensu recent authors, not as to type, which was a BLUE-flowered plant); but the two species have many significant characters, which will be fully presented in Part II. The bottomland swamp, back of the James, at Indian Point is carpeted with *Ranunculus carolinianus* DC. at its probable northern limit, and *Aneilema Keisak* Hassk. (discussed by me at length in the last Virginia report) closely mingles with it, while *Euphorbia obtusata* borders the low woods.

Farther down the James, in Surry County, the northern and upland *Carex prasina* occurs at two stations some miles apart; the range of *Chaerophyllum Tainturieri* was extended slightly northward; *Conopholis americana* was found in such quantity as we had never imagined; and we added *Orobanche uniflora* to our list of species on the Coastal Plain. In a churchyard at Surry Courthouse *Aira praecox*, certainly rare in Virginia, was growing; and we were told of yellow lady's-slippers, though we did not see them.

We visited the courthouse-grounds of Prince George Court-

[1] Unless otherwise noted the maps in this paper are based on the material in the Gray Herbarium and the Britton Herbarium (New York Botanical Garden), with trustworthy records (as those in Mohr's Plant Life of Alabama) added. Other herbaria would supply more stations, but the general ranges would probably not be materially altered.

house, Surry Courthouse and Isle of Wight Courthouse, all comparatively near the James River, because we hoped there to find *Alchemilla microcarpa* Boiss. & Reuter and *Draba brachycarpa.* One or both of these we had found in the lawns and open ground by the courthouses of Greensville and Southampton Counties and we had jumped to the alluring conclusion that they were being spread by the foot-wear of the officers of the circuit courts. When we explained our hope to court-officers at Isle of Wight Courthouse, they promptly said: "It's no use; we James River counties are on a different circuit". They were right; the *Draba* and *Alchemilla* are not there. We could establish no evidence that the court-officers of the more northern counties had been "bootlegging" weeds from the lawns of the more southern judicial circuit.

The region of Carey Bridge (over the Nottoway) and of Applewhite's Church, in Southampton County, had proved worth while in 1938 and 1939, with an abundance of highly localized and interesting species found there: *Tetragonotheca helianthoides, Sida inflexa* Fernald, *Polygala polygama,* etc. We, consequently, make a point of checking the area as often as possible for something previously overlooked. The brief visit there on May 7th gave us typical *Amsonia Tabernaemontana* (recorded by me a year ago) and a colony, on the wooded bank of Three Creek, of typical *Viola septemloba* LeConte, also not previously known from Virginia, although it will not be surprising if critical study reduces to it some of the more recently proposed northern species. Near by, on the wooded slope by Three Creek, north of Applewhite's Church, a rather definite new *Carex* was discovered, evidently allied to *C. digitalis* but with peculiarly inequilateral and arching fruits, an undescribed plant, although already represented in the Gray Herbarium from eastern Georgia and northwestern Florida.

At another area on Three Creek, just at the "fall-line" northwest of Emporia, the rich woods were more those of the Appalachian Upland than of the Coastal Plain. We already knew this transition-spot with its upland vegetation of *Scleria oligantha, Chamaelirium luteum, Stellaria pubera, Silene virginica, Clematis ochroleuca, Sanicula Smallii, Coreopsis auriculata* and other Alleghenian species; but we were not prepared to find

close to the Coastal Plain *Ligusticum canadense, Thaspium trifoliatum* (L.) Gray, var. *flavum* Blake, the upland yellow-flowered representative of the smaller purplish-flowered Coastal Plain *T. trifoliatum*, and, closely simulating it, the upland and transcontinental *Zizia aptera* (Gray) Fernald (*Z. cordata* sensu most authors, not *Smyrnium cordatum* Walt., its basinym). Migration only a few rods down the valley would bring all three definitely into the Coastal Plain. In fact, one of them was found, in June, well to the east of this rock-ribbed boundary. Along a path in these woods, some miles from the nearest town and with only a small clearing (quite innocent of the plant) near-by, was a fine colony of the handsome *Vicia grandiflora* Scopoli, a European species with flowers up to 1½ inches long, the yellowish corolla suffused with lilac or black dots. Dr. Robert Tatnall had been getting it on the Eastern Shore; but how it got isolated in this remote spot is a problem, a problem the more complicated because in August two other equally isolated new arrivals were found in profusion at the border of these woods. At another point just above the "fall-line", this time on the Appomattox slightly above Petersburg, we got many species from the rich woods which we know definitely to creep over to the Coastal Plain; but there were two, *Amsonia Tabernaemontana*, var. *salicifolia* (Pursh) Woodson, and *Scutellaria nervosa*, which we still yearn to see native slightly farther east.

So much for the rich woods. A brief visit to the sandy pinelands near Cathole Landing, on Somerton Creek west of Factory Hill, gave us good returns. The plants most worth special record are two. *Sphenopholis filiformis* (Chapman) Scribner, the most delicate member of the genus, a species not recorded from north of the Carolinas and Tennessee, has a nice station on one sandy ridge south of Tom Hunter's. Along the branch which empties into Somerton Creek we were made very uncomfortable by a tall (up to 10 feet high) sprangling bramble. Since it differed from any we had previously encountered we painfully and dutifully took three sheets. It is fortunate that we thus salved our consciences, for the flowering material is a close match for the type of *Rubus floridus* Trattinick, a long-lost species, described in 1823 from material sent to Vienna by Enslen from somewhere in the South, and, according to Bailey,

it has never been rediscovered. It is unfortunate that we did not know its full interest when we found the colony, for we should then have overlooked the pain and taken abundant material. Still more unfortunately, when we returned to the station in June of this year, the effects were everywhere evident (dried-out and dead leading shoots and blighted fruits) of a late spring frost which had hit the region and had caught practically all the floricanes of *R. floridus*. Again, three poor fruiting bits were all we got. The station is easily reached, however, and another year should yield plenty of good material. On the way there, if the searcher takes the proper sandy side-road[1] southwest of Marsh Hill School, he can see a considerable colony of *Rhododendron atlanticum* (Ashe) Rehder, with the corollas cleft to base into slenderly linear to filiform segments, a most bizarre form (PLATE 692) when in full bloom.

The inundated woods, swamps, thickets and clearings centering on Stony Creek in Sussex County always yield good things. The swamps (with back-flow from the Nottoway) are so extensive, from north and west of the town to some miles to the south and east, and their proper exploration physically so exhausting that we have never made a thorough examination of them; but whenever we stop in passing we are always repaid. Halting on this trip to look into a damp fallow field full of *Alopecurus carolinianus* Walt., *Agrostis Elliottiana, Poa Chapmaniana, Sibara virginica* (L.) Rollins, *Callitriche deflexa* var. *Austini,* and other vernal and quickly passing species, we chanced to wander across the road to the uncleared and deeply drowned margin of the woods. There, covering a good portion of an acre and only a few rods from a spot we had previously investigated, was a solid colony of the northern and transcontinental ("New Brunswick to British Columbia, and southward to Tennessee . . . New Mexico and southern California"—*Mackenzie*) *Carex lanuginosa*, new to the known flora of Virginia and surely not to have been expected among such austral associates. This addition to the flora must finish the records for May, except that, in wet woods along a small branch north-

[1] When we first encountered this particular road, with its water-holes, asymmetrical ruts and floating corduroys, Leonard sought out a farmer in a distant field, to ask about driving over it. Returning to the car he reported: "He says 'the road's not bad if you knows how to drive over it!'" Leonard knew how.

east of Sebrell in Southampton County, we came upon a few plants of very erect and wholly typical *Dryopteris cristata* (L.) Gray, another northern and transcontinental (even circumboreal) species, which seemed as much out of place on the Coastal Plain near the Carolina line as does *Carex lanuginosa*, or as do such other boreal species of the general region as *C. Buxbaumii* Wahlenb. ("Newfoundland to southern Alaska", etc.), *Caltha palustris* or *Drosera rotundifolia*. This localized station for *Dryopteris cristata* is on land which, at the opening of the 19th century, was part of the vast domain of Edwin Gray,[1] the host of Frederick Pursh, who in this region established northern limits for many extremely southern species: *Asimina parviflora* (Michx.) Dunal, *Quercus laevis* Walt., *Lobelia glandulifera* (Gray) Small, *Carphephorus bellidifolius* (Michx.) T. & G. and, best of all, *Litsea geniculata*, which is characterized by Small (under *Glabraria geniculata*) as "One of our rarer shrubs. . . . Its closest relatives . . . tropical".

In June (4–14) I was met at an early afternoon train by Long, with a bunch of *Bromus catharticus* in his hand, and Leonard; and, since it was not worth while to go far afield, we returned after lunch to the wooded banks of the Appomattox below the Norfolk and Western station in Petersburg. We knew from a visit the preceding autumn that there were rich alluvial woods in which travel was made difficult by tangles of *Clematis Viorna* and by shoulder-high thickets of *Laportea canadensis*. We were, therefore, not surprised by the abundance of *Staphylea* and other calcicoles. We were not prepared, however, to see in southeastern Virginia so distinct a species as *Carex conjuncta* ("New York . . . to the District of Columbia, and westward to South Dakota and eastern Kansas"—*Mackenzie*) making solid stands. Mackenzie says "4–8 dm. high" but on the Appomattox it vies with *Laportea* and reaches a height of 10.5 dm. (3 feet, 6½ inches). It is here very abundant and handsome and two days later we were collecting it on the north bank of the James. It is another indication of the lack of general interest in the more technical groups that so conspicuous a species should be "new to Virginia". On the upper banks of the river, partly in natural habitat, partly in railroad cinders, so that

[1] See Rhodora, xlii. 362 (1940).

their status as natives is questionable, *Carex Leavenworthii* was growing; and *Rubus trivialis*, at its northwestern outpost in the state, and *R. centralis* Bailey, extended south from Stafford County, entangled their creeping stems.

Farther out, definitely on cinders of the railroad yards (of the Atlantic Coast Line and the Norfolk and Western) there is no question that most of the plants are adventive, though some are evidently natives resisting invasion. *Bromus catharticus* abounds, *B. sterilis* has a foothold, and *Festuca octoflora* is bafflingly variable. Typical *Sphenopholis obtusata* (with glabrous sheaths) is there but probably adventive, since the common native of southeastern Virginia is var. *pubescens*. *Rumex altissimus* has crept south from the region of Washington and *Chaerophyllum Tainturieri*, var. *floridanum* northward from South Carolina; and *Anthriscus scandicina* (Web.) Mansfeld (*A. vulgaris* Fries), a new wanderer from Europe, has come to stay. Most of these plants, except the last, with the turpentine-like oil of which I unsuccessfully tried to make Long flavor his tea, would scarcely excite the enthusiasm of those whose "botany" begins and ends with showy flowers; but the beautiful colony of *Heliotropium europaeum*, with cymes of rich purple flowers, would win their applause, assuming that its great beauty compensates for its lack of the expected fragrance.

On the 5th we went south to the Nottoway, to secure ripe material of the two new *Carices* and to pick up any novelties occurring with them. When we parked the car on the soft shoulder by the river west of Homeville, where calcareous bottomland soil had been used for the shoulder, the effect of thus loosening it was at once apparent in the gigantism of the plants invading it. This stimulation to growth was well displayed by *Plantago virginica* with spikes nearly a foot long. Ordinarily spikes half that length are considered near the maximum size. The two new Carices were both in good ripe condition, settling their achene-characters; but our attention soon turned to another plant which, since we first saw it along the Blackwater in 1936, has been puzzling us. We, of course, were very familiar with *Justicia americana* (L.) Vahl (*Dianthera*), which carpets much of the lower James, and we had become familiar with the very different and exclusively southern *J. humilis* Michx.

(*Dianthera ovata*) in Southampton and Nansemond Counties. The plant which troubled us is midway between those two species in habit and inflorescence and it inhabits deeply shaded bottomlands and margins of quiet and shaded waters from south of the James to the Carolina line. We were still worried by it but, actually, it was in June of the current year before we brought together side-by-side fresh flowers of the three. Although this final study belongs more explicitly to a report on the work of 1941, it has so long been in progress that I am including in Part II an account of the new species with illustrations (PLATE 693) of the very different corollas, stamens and seeds of the three.

On the bottomland just east of Carey Bridge Long collected the prize specimens of *Mitchella repens*—with corollas three fourths of an inch long. In fact, much of the Mitchella in this quarter of Virginia has the flowers larger than we are used to farther north but I have been unable to find any definite morphological character to separate the two, although in March Pease had specially commented that the plant in Southampton "looked" unlike that of New England. The genus was named for John Mitchell, who lived near the mouth of the Rappahannock and in 1748 published a small tract on the plants of Virginia. It cannot now be settled (Mitchell's plants, presumably in England, being inaccessible until after the war) what form he had. In a small cypress swamp on the eastern bottomland of the Nottoway at Carey Bridge there is a beautiful *Carex* of § *Ovales*. It certainly "looked different" and its very large and cordate or round-based perigynia show it to be *C. reniformis* (Bailey) Small (MAP 2), a very rare species of the region from Florida to Texas, north, very locally, into eastern Georgia, northern Mississippi and eastern Oklahoma; and now in Southampton County, Virginia. Directly across the river, at a springhead in the wooded bank, we soon discovered the first definite station[1] known for the famously rare true *Sphenopholis pallens* (not *S. pallens* of most authors which is the transcontinental *S. intermedia* Rydb.), which was described 134 years ago from material of indefinite origin sent by Muhlenberg to Sprengel and has subsequently been known only from a second collection

[1] See Rhodora, xlii. 356, 357 (1940).

made somewhere in South Carolina. Since Elliott and Muhlenberg freely exchanged material and Elliott's herbarium contains much from Muhlenberg and Muhlenberg's much from Elliott, it is not improbable that the original material sent by Muhlenberg to Sprengel came, not from Pennsylvania as assumed, but was originally received by the sender through Elliott. At any rate, Carey Bridge and the Nottoway still retain their prestige!

The next day, June 6th, we swung northward. In early April we had found along the James, slightly west of Varina, a particularly rich slope and wooded bottomland, and northeast of there, at our old springy and boggy area west of Elko Station, there was an immature *Tradescantia* which we wished to check. On the way, in passing through the eastern border of Richmond, near the limit of tide on the James, we saw that *Zizaniopsis*, characteristic of tidal shores, had extended as far as possible up-river; and with it was a white-flowered *Convolvulus* which could be only *C. sepium*, var. *fraterniflorus*, of "The Prairie and Great Plain region", "Illinois to Montana, south to Arkansas and New Mexico"—Tryon in RHODORA, xli. 422 (1939). We are beginning to be hardened to such ranges!

The slopes and bottomlands west of Varina were as productive as we had anticipated, with lush growth of calcicolous species. Here, again, was *Carex conjuncta*, with the northern and inland *C. normalis* Mackenzie and *C. tenera* Dewey, the latter new to Virginia. *Xanthorhiza simplicissima* Marsh. (*X. apiifolia*) greatly surprised us, for we thought of it as an upland plant, though a few days later we were getting it in Southampton County and, still more surprising and to make a thorough job, finally in Nansemond County at the border of pine barren!

The greatest "jolt" at Varina, however, was when we found side-by-side two quite distinct members of the genus *Heuchera*, one of them a coarse plant with deeply cordate and heavy foliage which required two weeks in press properly to dry; the other smaller, with the thin leaves subtruncate at base and coming out of press in three days. The monographers of the genus, evidently without looking up all the specimens cited by Linnaeus, have selected to stand as typical *Heuchera americana* L. (the only Linnean species and, therefore, the type of the genus) a form which they surmise to be typical: "Since it is

the only form of *Heuchera americana* that occurs in tidewater Virginia, whence apparently, came the plants seen by Linnaeus, it appears that this variety rather than the more widespread Northern and Western one next discussed must be taken as the type of his species. This conclusion is borne out by the fact that this is still the form cultivated in European botanical gardens under the name of *H. americana*".[1] But here, growing together, were two members of the group; while the plant treated by Rosendahl, Butters & Lakela as true *H. americana* is relatively frequent (at several stations) in tidewater as well as upland Virginia and at two points in tidewater Virginia we collected "the more widespread Northern and Western one" which the monographers felt could not be typical of the species because they had not seen it from tidewater Virginia. Further to complicate the matter, in June, 1941, we have been collecting from extensive colonies on the lower James (within the mail-delivery area of Smithfield) gigantic plants with panicles nearly a foot and a half long and up to 6 inches broad, leaves heavily soft-pilose, and scapes almost as shaggy as in the most extreme plant of the Ozarks. This and some of the others are in areas where they could scarcely have been missed by early collectors; and it is quite certain that no one of the five can be singled out as type of the genus *Heuchera* and of *H. americana* simply because "it is the only form . . . that occurs in tidewater Virginia". At the present rate of discovery we can hardly feel certain that we have reached the end; and until the specimens cited by Linnaeus are critically studied it cannot be determined just what is the type.

The genus *Heuchera* started in 1737 almost simultaneously in Linnaeus, Genera Plantarum, ed. 1: 68, where it was described without statement of source or of origin of name, but with a single reference to Boerhaave, and in Linnaeus's Hortus Cliffortianus, 82 (1737), where earlier references (to Hermann, Plukenet and Boerhaave) were cited and the plant said to "*Crescit in* America", the genus named for Johann Heucher of Wittenberg. To me the plant of Hortus Cliffortianus, of which a good photograph is before me, seems to be the type. It was the plant actually known to Linnaeus and clearly bears his inscription

[1] Rosendahl, Butters and Lakela, Mon. Gen. Heuchera, 56 (1936).

"americana"; while the evidence is that he had nothing in his personal herbarium in 1753 (starting point of specific nomenclature) so identified. But Linnaeus cited plants of Clayton and others. These (all in Europe) can not just now be identified. It is fairly clear, however, that Hermann's plant of *Cortusa americana,* a name still earlier cited by Boerhaave and later cited as a synonym by Linnaeus, and from which, it is possible to argue, Linnaeus might have borrowed his specific name, is characteristic *H. villosa* Michx. Hermann's plate is to me of unmistakable *H. villosa* and the old descriptions defined the "flore squalide purpureo villoso". As yet *H. villosa* is not known from east of the Appalachian Upland but that should not be disconcerting, for many plants (including some from Clayton[1]) very early reached Europe from the mountains of Virginia. Rosendahl, Butters & Lakela separate their § *Villosae* from their § *Americanae* by "Outside of the flower villous" in the former, contrasted with "Outside of the flower glandular-puberulent without any villous hairs" in the latter. With the earliest pre-Linnean accounts of *Cortusa americana,* or of *Mitella americana* of Boerhaave, calling for villous flowers, with Hermann's plate showing characteristic *H. villosa,* with Linnaeus's own material of Hortus Cliffortianus a quite different plant, with four or five different plants now known in tidewater Virginia and the likelihood of others being there found, it is certainly wiser (and easier) to defer the answer. This situation, however, vividly illustrates the complexity of the flora of southeastern Virginia and the errors which may result from an assumption that it is sufficiently known.

The *Tradescantia,* forming a large colony west of Elko Station, proved, appropriately enough, to be *T. virginiana,* although Anderson & Woodson in their monograph of the genus cite no material from the Coastal Plain of Virginia. Near it, while we were inspecting our small colony of *Helonias bullata,* we suddenly remembered that *Carex canescens* var. *disjuncta,* which was abundant in the bog, had not been seen by me, when I described

[1] "John Clayton (1693–1773) . . . collected plants extensively in eastern Virginia, and was also much interested in the plant life of the interior. He seems to have traveled into the interior to some extent. . . . He also encouraged travelers to bring plants from the western sections. We find in some of his letters mention of plants from as far west as Wythe County [in the Alleghenies]"—A. B. Massey, *Plant Hunters in Virginia,* The Commonwealth (Richmond, Va.) vi. no. 4: 14 (April, 1939).

the variety, from south of Maryland. It was, therefore, worth collecting, although over-ripe. We had heretofore regarded *Lapsana communis* as relatively rare; but the embankments of the Chesapeake and Ohio, west of Elko, are covered by a low thicket of it and since we had seen it near the same railroad in Richmond, 18 miles to the west, it has evidently got a real foothold. The only other plant worthy a note here is the infrequent *Galium parisiense*, which forms a thin carpet in the cinders near Elko station.

It is unnecessary that the remaining notes on the June work should be strictly chronological. The thought having gradually but very forcefully evolved, that in southeastern Virginia many of the most interesting plants are "not away from the Nottoway", we finally conceived a rapid capture of them all by what is now known as a *Blitzkrieg*. Study of the contour-sheets showed that, beginning with Double Bridge, where the Nottoway enters the Coastal Plain, thence swinging eastward, then northward, and finally southward, uniting with the Blackwater at the North Carolina line, there are at least 16 bridges across the river in the Coastal Plain. There are also various railroad-bridges and old ferry- and boat-landings, as well as other old but perhaps passable routes to the river. Our work was cut out but, as yet, we have "contacted" the river at only a few points; these have usually proved worth while. The Nottoway rarely "lets us down". Starting south of Littleton on a sandy sideroad, to reach the river at Peters Bridge, we were soon startled by the vivid show of orange-yellow which could not come from any of the endless color-forms of Butterfly-weed, *Asclepias tuberosa*. Leonard slowed down in the deep and slewy sand and we made a first-hand acquaintance with the splendid southern *Lithospermum carolinense* (Walt.) MacM., heretofore known from Florida to Texas and Mexico, north to Arkansas and Oklahoma, and in the East to sand-hills of South Carolina. All about Chub, for at least two miles north and south, the dry white sand of open woods and clearings is brilliant in June and early July with the gorgeous infloresccences. The usual "sand-hill" plants of the South are there and new northern limits for several of them, *Quercus cinerea*, *Stillingia sylvatica*, etc., were

established. That was a good start and it was evident that our new plan of campaign was going to work.

The wooded bottomland between Chub and Peters Bridge is particularly rich and most species of such woodlands reach phenomenal development, while *Asclepias purpurascens,* which we once thought to be rare on the Coastal Plain, is very handsome and abundant. At the crest of the bank immediately above the river, however, we got our two prizes, two montane species new to the Coastal Plain: *Tradescantia canaliculata* Raf., which Anderson & Woodson in their monograph of the genus map for Virginia only from west of the Blue Ridge; and *Stenanthium gramineum,* another characteristic plant of the mountain region.

Another day we visited two other bridges over the Nottoway. One, Double Bridge, we well knew, but we thought that by approaching it from down-river, instead of from the Piedmont, we might pick up some novelties. Somewhat north of Orion (pronounced *ŏr-i-ŏn*) we were attracted by rich woods sloping to the river and there, among other good things, we found the characteristically broad-triangular and abruptly almost cuspidate-acuminate, glabrous foliage which very closely matches the type of *Viola latiuscula,* hitherto known only from calcareous western New England, eastern New York and northwestern New Jersey. It was accompanied by the beautifully distinct and rather ornamental southern *Carex oxylepis* and by the *Heuchera,* already referred to, which had been supposed not to occur in tidewater Virginia, the plant treated by Rosendahl, Butters and Lakela as *H. americana,* var. *brevipetala.* Here, also, was unmistakable *Zizia aptera,* the upland and nearly transcontinental species which had so surprised us when we found it at the "fall-line" northwest of Emporia. In the woods north of Orion it is well below that boundary-line. Best of all, along the little brook in these woods were carpets of young stalks of the weak-stemmed *Aconitum* which we already know at Carey Bridge. When we finally get it in flower and fruit, if we ever do, it will presumably prove to be the montane *A. uncinatum.* The colony at Carey Bridge was under 40 feet of water during the terrible freshet of the following August; that near Orion barely escaped, but in early September the trailing and leaning stems

scarcely showed any indication of flowering. In October, if freshets or drouth do not spoil it, we are hoping for conclusive material of the plant. The flowering material in the Gray Herbarium of *A. uncinatum* was collected from August 9 to October 10.

North and northwest of Jarratt the boundary between Sussex and Greensville Counties follows the sinuosities of the Nottoway and the bridge next below Double Bridge is called, on the contour-sheets, Readjuster Bridge, although, when in Jarratt we asked how to reach it, our informant looked puzzled by the big word but admitted that by following dirt roads as sinuous as the river we should come to *a* bridge. The southern end of the bridge is at the northeastern sharp angle of Greensville County, about due north of Orion, the northern end in the reentrant western angle of Sussex, just south of what seemed like an unromantic small village with an unromantic name, Peanut. The road from Jarratt finally straightens out and proceeds for a mile or two through swampy woods and argillaceous clearings, sometimes very wet but after drouth with an almost impervious baked-clay soil. In these clearings there is a rank growth of many species and we collected many of them to establish records for size (*Panicum polyanthes*, for instance, with leaves more than an inch and a quarter broad), others for county records (*Juncus diffusissimus*, for example, our first from Greensville County); but the most important plant, perhaps, was typical *Hypericum denticulatum* Walt. We already knew var. *ovalifolium* (Britton) Blake from three counties farther east, but the typical variety of the species seems to be new to Virginia.

When we reached the Sussex end of the bridge (south of Peanut) I turned south on the wooded bottomland, Long north. My attention was promptly drawn to a perplexing swale of sedges, but before I could concentrate on it a call for help came from above the bridge. Hurrying to Long's aid I found that all he wanted was botanical, not physical, support. He was legitimately puzzled by the flowering and fruiting aquatic in a backwater pool by the river, which failed to register. I, too, was puzzled by it, until I remembered *Peplis diandra* Nutt., chiefly of the Mississippi drainage (MAP 3), the plant which has been unjustifiably separated from *Peplis* as *Didiplis diandra*. Our

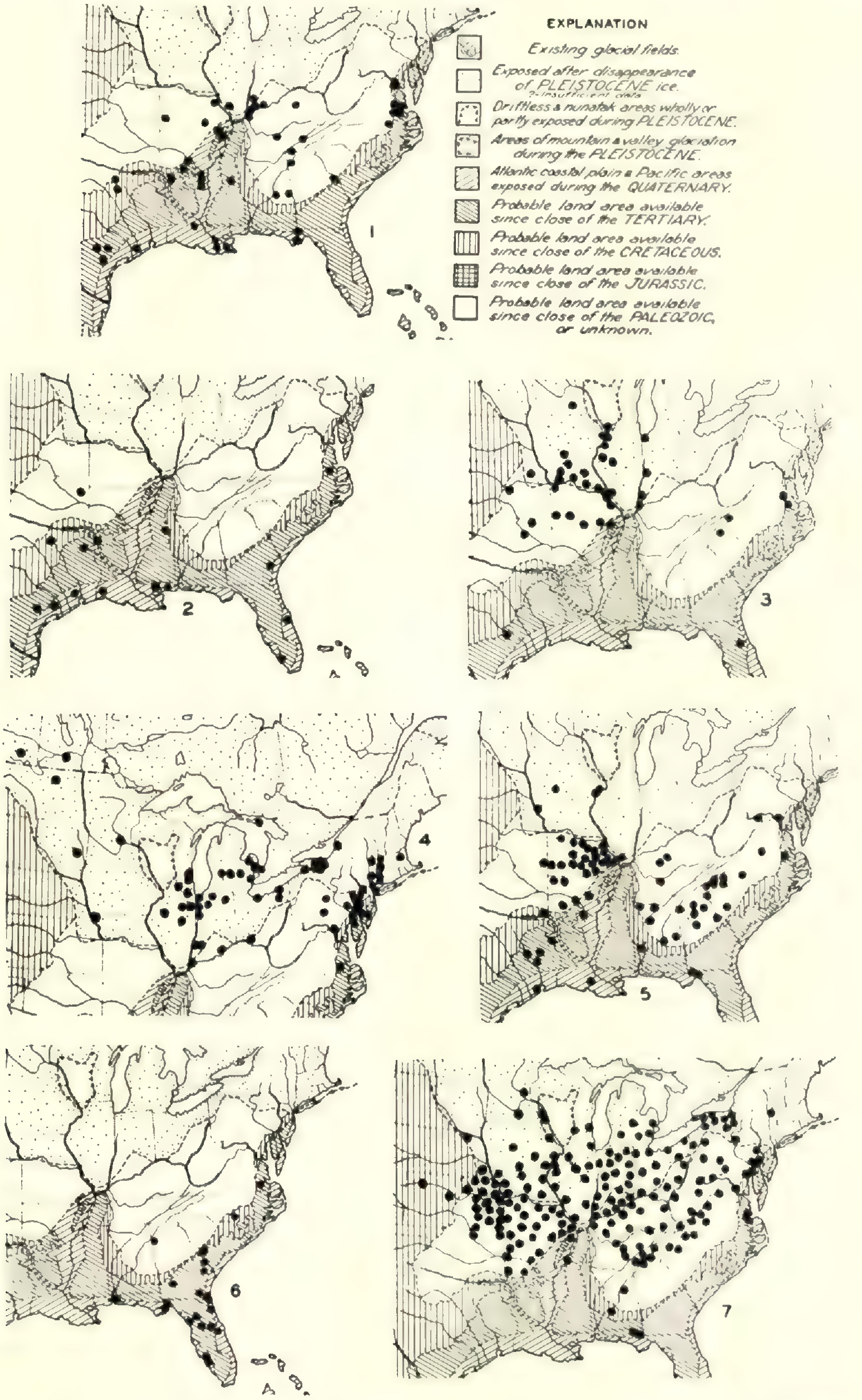
plant was certainly *Didiplis* or *Peplis,* but it is very rare in the East. The only stations I have located east of western Indiana and eastern Missouri are two in the upland of North Carolina, our new one, one at the "fall-line" in Chesterfield County, Virginia[1] and, far remote from the others, one in Florida. Just as remote is a Texan station. It is humiliating to record that Long and I, making an off-hand misidentification, had collected remarkably large terrestrial plants of the *Peplis* in Chesterfield County and that the many duplicates were distributed by me and recorded in RHODORA, xli. 477 and 570 (1939), as the habitally similar *Oldenlandia Boscii* (DC.) Chapm.[2] After we together took the necessary two dips to secure the best material of *Didiplis* we returned to my original problem. The dominant *Carex* which had astounded me was *C. tetanica* (MAP 4), a northern calcicolous species, occurring from New England to Saskatchewan, with its previous southeastern limit in the upland of Maryland. While we were absorbed with *C. tetanica* and an obvious hybrid of *C. lurida* and *C. squarrosa,* Leonard remarked "I never saw a clover like this". Neither had we. In openings in the thicket and in the border of the woods he had discovered a good colony of Buffalo Clover, *Trifolium reflexum* (MAP 5), the true southern and pilose *T. reflexum,* not the more northern and glabrous var. *glabrum* Lojacono in Nuov. Giorn. Bot. Ital. xv. 150 (1883). The latter extends north into central and western New York and southern Ontario. Only typical pubescent *T. reflexum* is included on the map. Torrey & Gray (1838) and others have given the northeastern limit of typical *T. reflexum* as in North Carolina; and Small, in his Manual, says: "northward only W of Blue Ridge, Fla. to Tex." etc. Professor Wherry, who intimately knows western Virginia, tells me that he has never met the plant there; and the only station in the state known to Professor Massey is one discovered in May, 1940, by Mr. E. W. Carson in Cumberland County. The old stations, where last collected in 1902, along the Potomac, kindly enumerated for me by Mr. E. H. Walker of the National Herbarium, seem to have been in Maryland. Mr. Walker states

[1] Too late for inclusion on the map other stations in eastern Virginia, as far north as the Chickahominy River.

[2] Those who received no. 9439 are asked to correct the identification to *Peplis diandra* Nutt.

that otherwise the National Herbarium shows nothing from north of North Carolina. Nevertheless, *T. reflexum* was originally published by Linnaeus (1753) with "*Habitat in* Virginia". He then cited an earlier description of a Virginian plant described by Plukenet (presumably received from Banister) and specimens collected by Clayton and described by Gronovius. Presumably the species, which naturally occurs in openings in loamy or otherwise rich thickets and woods, agriculturally promising habitats, was once more generally distributed in the state. At any rate, we now know a good station at the edge of the wooded bottomland of the Nottoway only a few rods from a still more isolated colony of *Peplis diandra*. In spite of a modern invidious connotation of the word peanut (as in "peanut politics"), no true botanist will jeer at Peanut, Sussex County, Virginia. That humble locality now has a dignified place on the botanical map of the state, and the Nottoway there maintains the interest we expect of it.

We had not wholly forgotten the pine barrens of western Nansemond and adjacent southwestern Isle of Wight. In the latter area we added *Amianthium Muscaetoxicum* and *Polygonella articulata* to the county list; and in the former we found a new station for *Calopogon pallidus* Chapm., some miles away from our first station, and with it young shoots of unmistakable *Gentiana Stoneana* Fernald. Our greatest delight, however, was in finding in full flower extensive thickets of the rare and distinguished *Zenobia pulverulenta* (Bartram) Pollard, discussed by me in detail in Rhodora, xlii. 471–473 (1940). All three forms (sometimes treated as species) grow together, very striking in their extremes, and the beautiful broad white bell-shaped flowers are deliciously fragrant. Most unhappily they lose their fragrance and become discouragingly blackened in drying. *Calopogon pulchellus*, in all color-shades from bluish-purple to pale pink, abounded and the white-flowered plant, forma *albiflorus* (Britton) Fernald, was positively abundant on one area—many scores of plants. Tom Hunter had invaded the springy sphagnous bog with his plow; and in his corn-field, heavily manured and fed with commercial fertilizer, the *Calopogon* lingered along the rows. It was a novel experience to collect this bog orchid as a "weed" in a cultivated field. It is supposed to be in-



MAP 1, range of MYOSOTIS MACROSPERMA; 2, CAREX RENIFORMIS; 3, PEPLIS DIANDRA; 4, CAREX TETANICA; 5, TRIFOLIUM REFLEXUM (typical); 6, PSORALEA CANESCENS; 7, CAMPANULA AMERICANA.

tolerant of lime; but the manure and the nitrates in the fertilizer seemed to have stimulated it and the calcium not to have injured it. From one hill of corn I extracted a plant three feet high, with leaf 7 inches long and 1¼ inches broad, flowers approaching 2 inches in breadth, 21 of them in a full raceme more than a foot long. *Calopogon* may yet become a garden plant!

The Peninsula of Virginia always yields good returns; so, on June 12th we made a brief circuit into York County. Near Grafton there is a swale bordering swampy woods which at once attracted us by its display of *Asclepias purpurascens*. Upon investigation the swale proved trebly interesting, for it is given over largely (for an acre or more) to the southern *Lythrum lanceolatum* Ell., a species we had known as far north as Virginia only from a little remnant of swale near Homeville (Florida to Texas, north to southeastern Virginia and Arkansas). With it was *Scirpus lineatus*, an inland and relatively northern type, which we had never seen in southeastern Virginia, although Grimes got it near Williamsburg. As we approached Yorktown, fields and clearings began to be showy with the dark purple globular umbels of a gigantic onion (more than a yard high, with very dense umbels more than 2½ inches in diameter); and some miles farther on, up-river from Yorktown, areas along the newly disturbed lands of the parkway are rapidly being invaded by it. It is superb to look at, but its deep-seated large bulbs, each producing a hundred or more small bulblets, make it a serious threat to hay-fields and pastures. It is far more vigorous and effective in rapid propagation than the pestiferous Field Garlic, *Allium vineale*, which, for two centuries, has occupied and tainted the fields of the Coastal Plain. Unless drastic steps are immediately taken to exterminate it (already a difficult task) before it goes any farther, eastern Virginia and adjacent states will be overrun by a new and highly flavored pest. It is a plant originating in the warmer parts of Europe and western Asia, *Allium Ampeloprasum* L., var. *atroviolaceum* (Boiss.) Regel. *A. Ampeloprasum* has a number of varieties, this one with a dense ring of essentially sessile bulblets borne about the base of the parent-bulb. For purely whimsical reasons we should have been glad to add to the Virginia list the oriental variety with the small

bulblets borne on long stalks, like a loose crown, about the parent-bulb, var. *pater-familias*. The name alone makes it sound "interesting but tough".

Other weeds have become established above Yorktown, some of them likely to spread, as they have done farther north. *Silene Cucubalus* Wibel (*S. latifolia*), a ubiquitous weed of fields and roadsides in eastern Canada and the northeastern states, is rapidly increasing along the parkway. It is a relatively harmless weed, however, and from its young and tender new leafy shoots in early spring a good purée, suggestive of pea-soup, may be prepared. It would be well, however, that the plant have an English name different from the long established Bladder-Campion. In the thicket slightly above Yorktown *Verbascum Lychnitis* abounds, a European species not very generally established in America; and on the sands along the river and farther west along the parkway a small Old World *Medicago*, with burr-like fruits, *M. minima* L., var. *compacta* Neyraut, has taken a firm hold. I have emphasized the weeds of disturbed soils, but the native flora in undisturbed areas is always interesting along the lower York. *Acer floridanum* Pax, apparently not previously recorded from the county, thrives and is made conspicuous by its chalky-white trunks; and under it in early spring a rich vegetation of early-flowering herbs may be expected. *Arabis laevigata*, growing there, is a good indicator.

Only one more plant need here be recorded for the June trip. This is the very low and stoloniferous, colonial and small-leaved *Amelanchier* which abounds in pinelands and other acid soils. Strongly suggestive of the northern *A. stolonifera* Wiegand, it is markedly different from that species in its very thin and relatively narrow leaves, with uniformly small teeth and compact flowering racemes, with very short pedicels. It was now fruiting; the rather dry fruits are also short-pedicelled and with erect calyx-lobes. It is a strongly marked species of the southern Coastal Plain, not heretofore generally understood, although André Michaux, a century and a half ago, had a good knowledge of it. It will be further discussed and illustrated in Part II.

Late March and early April had been relatively unproduc-

tive of novelties, May had done better by us, and June had given splendid returns; but by July our restricted time prevented our reaching half the areas we wanted to examine, while in late August and early September novelties and new problems were so frequent that it was difficult to convince ourselves that, for seven seasons we had been working in the field at intervals on the flora of southeastern Virginia, five seasons with our routes radiating from the same center, Petersburg. When we reached Petersburg for our July work (July 9–19) we were grieved to learn that Leonard could no longer help us. He had, however, done the best thing possible for us, delegated his position to his brother, Frank Birdsall, a graduate of William and Mary and now at the head of the large Seaboard High School in northern North Carolina (over the line from Emporia). Frank promptly adapted himself to the new work, drove skillfully and with Leonard's ability and willingness to tackle difficult roads, and was a genial and always interesting and interested companion; we felt ourselves very fortunate. Our first venture, obviously, was to the dry sandy woods at Chub, where *Lithospermum carolinense* has its only known station north of the sand-hills of South Carolina. Here the southern *Bulbostylis ciliatifolius* (Ell.) Fernald was found at a new northern limit and other "sand-hill" types, rare so far north, were collected. For years we had been searching for *Baptisia villosa*, collected nearly a century and a half ago by Frederick Pursh in Southampton and much later by Canby in the same county. Consequently, when, at the border of the woods, I stumbled upon a strange erect leguminous plant passing out of flower, I thought that we had at last located it. But a little examination showed that I was wrong. The disappointment was more than cancelled, however, for we were collecting *Psoralea canescens* Michx., a yellowish-flowered species of sand-hill and sandy pinelands of Florida, Georgia and Alabama, heretofore unknown north of southern North Carolina (MAP 6). It is certainly an appropriate companion for *Lithospermum carolinense;* but another occupant of the same woods, in the largest colony I had ever seen (I cannot speak for Long), was a wholly inappropriate companion for those two—*Scrophularia lanceolata* Pursh, hundreds and hundreds of plants, a species occurring, accord-

ing to Pennell, from "Cape Breton Island to British Columbia, south to [mountains of] Virginia", etc. Here at its southeastern limit of range, it is in sandy oak and hickory woods where in August we found typical *Sanicula marilandica* (northern Newfoundland to Hudson Bay and British Columbia, south to Nova Scotia, New England, Virginia, upland to northwestern Florida, Great Lakes states, northern Kansas and Colorado) growing with the largest colony we ever saw of *Hexalectris spicata* (Mexico to Florida, north to Maryland, Virginia, etc.) and with other species hitherto "unknown from north of South Carolina"; and close at hand, in more sterile areas, other such meetings of North and South were noted. Another such amazing juxtaposition was found when we went down the slope south of Chub to the sphagnum-carpeted spring-heads bordering the bottomland-woods of the Nottoway. We went for a drink of cold spring-water, but in getting at it we were forced to push back the fruiting branches of *Rhododendron serrulatum* (Small) Millais of "Ga. to Fla. and La." (Rehder, Man. Cult. Trees and Shrubs, ed. 2). We then crouched, to get our drinks, in a carpet of *Campanula aparinoides*, the first colony we had ever met in Virginia of this northern and upland flaccid plant (Maine to Wisconsin, Nebraska and Colorado, south to upland of Georgia, etc.). What would those who are "sold" on the exact working of life-zones in mesophytic lowland eastern America do with these plants? Their behavior is as reprehensible as the commingling in Newfoundland of *Schizaea pusilla* with *Sparganium hyperboreum*, or the interlocking in western Nova Scotia of *Ilex glabra* and *Ledum groenlandicum*, or the climbing of *Picea mariana* there by *Smilax rotundifolia!*

Across the Nottoway, south of Peters Bridge, there is such a domination of the sandy woods by *Quercus cinerea* and its almost endless variations and apparent hybrids that we got the impression that this is one of the most unstable of species. The hybrid, × *Q. subintegra* Trelease (*Q. cinerea* × *falcata*) is there in quantity. Just below the bridge, in the sandy loam of the woods above the Nottoway, the Coastal Plain *Thaspium trifoliatum* abounds and with it the northern and inland *Scutellaria parvula*, var. *ambigua*, a rare plant in Virginia. Still farther south of Peters Bridge and over the line in Southampton County,

in the thickets and woods near Raccoon Creek, we came upon our second Coastal Plain colony of the upland *Xanthorhiza;* and not far away the upland *Pycnanthemum Torrei* abounded. North of Peters Bridge, near Lumberton, lies Chappell's Millpond (now known as Honey Pond). The margin of the pond is an aquatic garden, with *Echinodorus radicans, Brasenia Schreberi, Potamogeton capillaceus* Poir. and other species already familiar; but we were more interested in the southern extension of *Potamogeton Berchtoldi* Fieber, var. *tenuissimus* (Mert. & Koch) Fernald, new to Virginia, and, also in the same category, *Ceratophyllum echinatum* Gray. We strained our backs, legs and eyes, bending over and carefully fingering, under water, thousands of plumes of the *Ceratophyllum* in a vain search for fruit. Fortunately, as pointed out in Part II, fruit is not absolutely necessary for identification of it.

With *Potamogeton* in mind, we remembered a slow creek at the outlet of Lee's Millpond, a dammed cypress swamp, in Isle of Wight County. Proceeding there, we found the stream covered with pondweeds. Among them were *P. epihydrus*, var. *Nuttallii* (Cham. & Schlecht.) Fernald, which, when we got it in the Chickahominy, fifty miles to the north, was then the first from south of the Potomac. Another pondweed, not yet fruiting, puzzled us but we looked forward to securing good fruit in late August. Going on to the pine barrens south of Lee's Mill we found, as we had expected, most of the characteristic plants of such areas; these need not be here enumerated. A few (very few) plants of *Calopogon pallidus* Chapm. established a record for Isle of Wight; and over the county line, just within Nansemond County, there was a bank of *Xanthorhiza*, bringing that upland species pretty far out into the Coastal Plain. The plant which most interested us, however, was an undescribed *Diodia*, with oblong leaves. It is here abundant in loosened sand, as along the Camp Company's lumber-railroad, and it had been on our minds ever since we originally got it in a similar habitat in 1936. It will be described in Part II. Near the road which skirts this barren there is a fine tree which is obviously a hybrid of *Quercus cinerea* and *marylandica*, × *Q. carolinensis* Trelease, new to the state; and, to continue evi-

dence of the difficulties caused by *Q. cinerea*, near Cathole Landing we found × *Q. caduca* Trelease (*Q. cinerea* × *nigra*).

Renewing the visits to the Nottoway, we first stopped at the bridge slightly southeast of Stony Creek; and there, instead of by the common pilose-leaved *Solidago gigantea*, the species is represented by the transcontinental and northern (Quebec to British Columbia, south to upland of North Carolina, etc.) glabrous-leaved var. *leiophylla* Fernald (*S. serotina* Ait., not Retz.). The other plant of special note, as not recorded in previous years from the Stony Creek region, is the leafy-stemmed yellow-flowered *Viola eriocarpa* Schweinitz, a relatively northern and inland plant which we were amazed to find on the Coastal Plain. As I shall show in Part II the name *V. eriocarpa* is antedated by 19 years by *V. pensylvanica* Michx., the name I am reviving. A little farther up-river, where the automobile-road crosses the Nottoway east of Huske, the bottom-land-woods are particularly fine. Here are the common species of such habitats, and some not so general, such as *Elymus riparius* Wiegand, rare in eastern Virginia, and *Eryngium yuccifolium*, sufficiently local to be worth here recording. All the *Corylus americana* here and wherever we have subsequently examined it in southeastern Virginia has glandless involucres. It is the shrub described by Alphonse DeCandolle as var. *missouriensis* on account of this lack of stalked glands on the involucre. The shrub with the involucre stipitate-glandular was assumed by him to be *C. americana* Walt.; but it is usually more northern in range than var. *missouriensis*. Walter made no mention of glands in describing his material from South Carolina and I have seen no material of the species from his region. His herbarium, preserved at the British Museum, is now inaccessible, but when it can be reached examination of the involucre will be in order. The most thrilling plant of this bottomland, however, is something apparently quite new. With prolonged and very pilose sheaths covering the nodes, the *Bromus* here has the folded lemmas with flat sides, the 2nd glume 5- or 7-nerved. It is quite unlike *B. purgans*, abundant along the James, a plant with exserted nodes, strongly inrolled lemmas and 3-nerved 2nd glumes. *B. purgans* in eastern Virginia flowers from late May into June and by late June the spikelets are

disintegrating. Our Nottoway plant begins flowering when *B. purgans* stops and continues through July. In its included nodes and prolonged sheaths, as well as in its flat-sided lemmas, it suggests the appropriately named northern and western *B. latiglumis* (Shear) Hitchcock, but that species has unique sheaths, with broad, horizontal summit-flanges prolonged into tapering appendages, and it differs in other characters from the Nottoway plant; incidentally, at the southern extension of its range *B. latiglumis* flowers from mid-August through September. In Part II I shall describe the new plant and illustrate details of all three species (PLATE 670). We also found it along the Nottoway at Green Church Bridge, Readjuster Bridge and Double Bridge, but could not find it on the James, the Blackwater or the Meherrin. Like the new *Carex* it is, so far as we yet know, "not away from the Nottoway". At Readjuster Bridge splendid trees of *Acer floridanum* still held their fruit (near Yorktown a month earlier the fruit had all fallen). Here the prickly vine, with fiddle-shaped leaves suggestive of those of *Smilax Bona-nox,* is, Long assured me, *S. hispida.* I bow to his understanding of the genus; I completely lack it, nor can I get real comfort out of any treatment I have seen! *Acerates* here was quite as perplexing as *Smilax;* again I give up. But the beautiful tall *Phlox,* abundant at the borders of swampy woods (south of Peanut) was more comforting. With its mottled stem, long-attenuate leaves and very prolonged and cylindric inflorescence it is unmistakable *P. maculata,* although the first we have ever met on the Coastal Plain of the state.

One day, having only a remnant of time, we went to Richmond to look for weeds about freight-sidings and waste lots. The crop was good but only a few species are worth comment. *Potentilla millegrana* Engelm., native of the prairies in the interior of the country, has come east; it is accompanied by superabundant *Froelichia gracilis,* upon which I commented a year ago, and along the canal from the James and all over the adjacent woods in one area the yam, *Dioscorea Batatas* Dcne., has taken full possession, climbing high or trailing in solid mats on the ground, the stems high in the trees abundantly flowering, those on the ground bearing only axillary small tubers, like tiny potatoes. A similar weeding of Petersburg yielded the

subtropical weed, *Gnaphalium spathulatum* Lam., the European *Sambucus nigra* L., probably thrown out from cultivation, and a second species of *Richardia*. In 1939 we were at first much excited when we found a solitary plant of the tropical American *R. scabra* L., but when, soon after, we found solid acres of it the thrill was lessened. In 1940 we did not happen to see *R. scabra*. Instead, we had a run on another tropical species, often in great abundance, *R. brasiliensis* (Moq.) Gomez. Small cites it only from peninsular Florida but in Dinwiddie and Henrico Counties, Virginia, it is well established. The distinctions, not too sharply brought out by Small, will be discussed in Part II.

We wished to get to Cedar Island in Back Bay where, in June, 1935, we had found, with Griscom, so many interesting plants. My friend of many years, Dr. Thomas Barbour, with characteristic generosity offered us the use of the old family place at Barbour Heights, on the outer side of Back Bay; but, since we learned of an available motor-boat which daily made the round trip from near Back Bay village to Cedar Island, it seemed simpler for us to cross in that way. On July 15th, therefore, we drove to Virginia Beach, thence to Back Bay, to consult Mr. Beals, who was in charge of renovations going on and some new construction for the club on Cedar Island. From Century House to "the Beach" was more than 100 miles. When we had ridden about three-fourths of the distance Frank meekly asked: "Are we going way through to the Beach without a stop? I'm dying for a smoke". We were speeding along the great trunk-road, without parking possibilities, which cuts directly across the northern edge of the Great Dismal Swamp. Hopeful tests in the past had invariably shown this stretch of clearing to be an almost uniform and uninspiring cane-brake, a dense jungle of *Arundinaria* higher than one's head. At the next cart-road, however, we turned in and parked. Frank was to have his smoke and we would get out and stretch. Almost immediately, however, the stretching was for a curious herbaceous *Smilax*, with leaves ending in almost tendril-like excurrent midribs. While we were puzzling over this (Long did not tell me just what it is) and collecting specimens, we wondered at the *Scleria* which here makes clumps, with arching culms and

pendulous or drooping axillary inflorescences. It somewhat suggested *S. setacea* Poir. but we were too familiar with that slender plant to see more than a habital suggestion. The achenes were perfectly smooth as in *S. triglomerata*, *S. nitida* Willd. and *S. minor* (Britton) Stone; yet it was none of these. The obvious procedure was to "play trumps". So we took a series; and study shows it to be *S. flaccida* Steudel, described in 1855 from somewhere in South Carolina and not subsequently recognized. The only material in the Gray Herbarium, besides our plant from Norfolk County, is from Florida, Mississippi and Louisiana. Its technical characters and other details will be discussed in Part II. After that experience we encouraged Frank to stop for a smoke whenever he wished!

There was some time for botanizing before dark and, as most wild areas between Virginia Beach and Munden had been visited by us at this season, we hit upon Sand Beach for our quest. We knew it of old but, coming here at a slightly different season, we proceeded to collect a few species not previously noted; and we ate, inordinately perhaps, the luscious big fruits of *Rubus Longii* Fern. Of the numerous blackberries of southeastern Virginia two stand out in memory and are always sought for their superlative fruit, the stiffly branched and often upright *R. Longii* of relatively sterile and dry soils, and the prostrate *R. Grimesii* Bailey, also of sandy or dry and argillaceous openings. Both of them should have a place among cultivated fruits. *Juncus bufonius* was here, a seemingly inane observation, but in nine years of botanizing in southeastern Virginia we have only rarely met this reputedly ubiquitous and supposedly cosmopolitan annual! *Panicum caerulescens*, a regular inhabitant of damp flats back of the dunes, was also present and with it was the northern coastwise *Elymus virginicus*, var. *halophilus* (Bicknell) Bush, our first from south of New Jersey. We also found a new station (this on an inlet to Rainey's Pond) for the always surprising and usually very local *Limnobium Spongia;* while the small *Galactia* on the flat back of the dunes threw me into perplexity. I thought that I had settled *Galactia* for the manual-range, but here and at other stations later in the season I became very humble. The group (likewise *Stropho-*

styles) needs fuller collecting; after that it needs a friend who understands it!

Promptly on the morning of the 16th we crossed with Mr. Beals and his helper, a young carpenter, to Cedar Island. The island has not been too much cleared and we were delighted to get back to the flora seen here six years earlier and to that seen on Long Island a year before. Those species need not again be enumerated. The forest is largely of superb Live Oak, both the typical small-leaved tree and the larger-leaved *Quercus virginiana*, forma *macrophylla* (Sargent) Trelease; and we gazed with delight at the great masses of *Ampelopsis arborea* (L.) Koehne high in the trees and repeatedly remarked upon the subtropical aspect of the forest. *Smilax* again intruded problematic tangles in our path. We did not mind the tangles; the problems are what worry me! *Kosteletzkya virginica* was here represented by the coarsely and heavily rough-tomentose southern var. *altheaefolia* Chapm. (*K. altheaefolia* (Chapm.) Gray), which we had not previously known so far north; the pools were full of true *Potamogeton pusillus* (*P. panormitanus* Biv.), not recorded from south of the Potomac; and at the southern end of the Island we came upon an extraordinary exhibition of *Typha angustifolia*, with the pistillate spikes variously slit into partially united, partially separated strands or quite split to base into 2–5 spreading or drooping portions. Just such abnormalities were discussed by Dr. Harold St. John in Rhodora, xliii. 85–91 (1941).

When the day's work at carpentering was finished Mr. Beals offered to land us, if we had a permit, on Ragged Island, part of the government holdings. My permit from the Superintendant, Mr. Harry Bailey, took care of this question and in the few minutes available we snatched, near the wharf, *Erigeron bonariensis* L., *Pluchea purpurascens* (Sw.) DC., *Verbena scabra* Vahl and other specialties of Long Island reported a year ago. Three large oaks stand near the landing. One is characteristic *Quercus virginiana*, another seems like a hybrid of *Q. nigra* and *Q. Phellos*, and the third, so far as I can see, is the hybrid, × *Q. ludoviciana* Sargent (*Q. falcata* × *Phellos*). A visit to these islands and to False Cape, late in the season, when the marsh plants are mature, would well repay the acute botanist.

We had been inclined to be sentimental over the great festoons of the rather rare *Ampelopsis arborea*, covering the Live Oaks on Cedar Island. Consequently, when, two days later, we stopped to investigate the adventives along the railroad east of Franklin and the plants of a waste lot in Franklin, we felt rather cheap: *Ampelopsis arborea* was there as a weed! Other weedy plants, like *Euphorbia marginata*, obviously came from garden refuse, though now well naturalized; but the abundant *Croton monanthogynos*, its range extended north from North Carolina, surely came out of no garden.

This stop was made on our way to the region of Joyner's Bridge, to follow side-roads through the sands east of the Blackwater. We had already visited the Bridge at three different times, but it was still possible to extend into Isle of Wight County a good number of southern species, *Bulbostylis ciliatifolius* and *Paronychia riparia* Chapm. for instance. The new *Diodia*, already referred to, was here abundant; the recently described *Tephrosia spicata*, var. *semitonsa* Fern., here almost justified omission of the qualifying first syllables of its name; and *Galactia* again caused perplexity. On one tree of *Quercus Phellos* the very narrow leaves had their lower faces white with minute pubescence; ordinarily, no matter how broad or how narrow the leaf in eastern Virginia, it is green beneath. Something may eventually come out of study of this complex group. The last plant to be mentioned from the July collections is a tall variety of *Lyonia ligustrina*, with unusually large fruits, found along a woodland branch near Joyner's Bridge. It proves to be the shrub described by the British dendrologist, Watson, in 1825, from a specimen cultivated in England, as *L. capreaefolia*. From the mass of variations of *L. ligustrina* I am able to pick out a series representing the same extreme and found from Florida to Texas, north to southeastern Virginia, western North Carolina, Tennessee and Arkansas. It and the other varieties of the species will be discussed in detail in Part II.

Northern papers had had brief mention of unprecedented mid-August freshets in Virginia and the Carolinas, but it was not until we reached Richmond that the vastness of the calamity fully impressed us. All Virginia from the lower James River southward and much of the two Carolinas was under water. A

week of torrential and unceasing rain, from the mountains to the Coastal Plain, had disrupted all normal traffic; much of Richmond, Petersburg, Franklin and other cities were drowned and it was impossible to guess when or where one could go and come. On our way to Century House long after midnight a guard stopped us, to say that we could not go far on U. S. Route 1; and next morning, when we started on two weeks of botanical exploration (August 19 to September 2), we were flagged at the start toward Courtland and Franklin and told that we could not even reach Homeville. Going on until we found the road completely submerged and were told of cars and families swept off the road by onrushing back-waters, we turned back some miles northwest of Homeville; instead of rare plants being "not away from the Nottoway" the river itself was miles away from the Nottoway and the plants within its reach were all ruined until the next spring. Since all roads leading to the Nottoway, the Blackwater and the Meherrin were thus deep under water, the stronger bridges drowned (sometimes, we were told, under 40 feet of rushing water), and all weaker bridges gone, our beautiful plan to devote our energies to the wooded bottomlands had also gone.

The only dry area we could think of was the freight-yards and waste land about Broad Street Station in Richmond; so we went there for the rest of the day. North of the station the waste ground and cinders were, at this season, a carpet of small adventives, the taller weeds having been destroyed. *Plantago indica* L. (*P. arenaria* W. & K.), now becoming rather general from Maine to Virginia, formed tiny thickets of bushy-branched plants and *Richardia brasiliensis*, here in flower and fruit, was abundant; but, having already had that, we were more interested in the mats of a somewhat arched-ascending *Euphorbia* which was new to us. It is very abundant and quickly distinguished at a glance from the prostrate *E. supina* Raf. (*E. maculata* of authors) and the nearly erect *E. maculata* L. (*E. Preslii*); and we found it next day some miles away, also on railroad cinders. It proves to be *E. humistrata* and adventive (like the equally abundant *Froelichia gracilis*) from west of the Alleghanies. Another plant new to our experience was a stiffly branched *Anthemis* with very short ligules, the Mediterranean

A. secundiramea Bivona, apparently a very recent arrival in America. At another freight-yard, where the clerk was much interested and helped us search for *Zornia bracteata*, which persists or has been slightly introduced there, we were delighted to find the southern *Erigeron quercifolius* Lam. We had collected it two years before in just such a place, the freight-yard at Charleston, South Carolina, but it has not been recorded from north of North Carolina.

This was only a small terminal but we were advised to go to a very extensive yard which was pointed out to us, for there we would surely find many additional species, brought in on freight-cars of one of the large transportation lines. Something in the proposition, which we took to be an invitation, miscarried or failed to coordinate; for next morning, when, driving up from Petersburg, we started into the extensive yard, we were promptly taken in charge by a plain-clothes detective and held for some hours, while questioned by one officer and another and by varying grades to higher officers, as "German spies" who had been "under observation for days" (we had driven to Richmond at noon the day before, returning to Petersburg for the night) and who were hiding their operations under the pretense of "looking for a weed". "Looking for a weed; get that? Yeah, looking for a weed!" The "false" white beard and the queer glasses (bifocals) of the old man were conclusive evidence and his botanizing pick was corroborative. Our friends in Richmond, deans and professors at the University, were all on summer vacation; the ticket-agent at Petersburg, through whom I had for years made reservations, could not be reached, the Norfolk and Western station in Petersburg being under water; Mrs. Bowman had gone shopping and all others who could identify us were away! It was a hot morning, so we had left our coats, containing letters, at home. There we were! When the Chief arrived, however, he graciously took us to Frank's waiting car where, fortunately, I dug out from among our contour-maps (government maps!) a letter two years old from our friend, Mr. John B. Lewis, then of Amelia, addressed to me at the Gray Herbarium. That was verification of our statement that I was Director of that institution, which had

meant nothing to the Richmond police;[1] and after a friendly visit with the Chief and the Police Commissioner we went on our way, with the good advice: in these feverish times always have identifications on your persons! We now do so. Every field-naturalist should. We are, to the officers, "queer people".

During the inquisition one of the police-officers had amused himself making imaginary passes at everyone near with my botanizing pick and exclaiming over its wickedness as a weapon. This implement is a copy of a Mexican tool brought from there many years ago by the late C. G. Pringle. Consequently, when, next day, the front pages of the papers carried pictures of Trotsky, his Mexican murderer and the implement used (the prototype of my pick), we congratulated ourselves that the pictures had not come out twenty-four hours earlier.

We had started for Yorktown to get better material of the tropical American *Euphorbia ammannioides* HBK. which, when, almost in the dark some years before, we had collected it there, was at its first known station north of Florida. We were so unnerved by the morning's experiences, however, that we hesitated to leave the car; and when we reached the sand-beach above Yorktown we were at first disappointed to find nothing but *Euphorbia polygonifolia* along the lower and looser sand of the beach. Nearly ready to give up, we went to the upper border of the beach. There, in more firm and unshifting sand, was our plant, plenty of it and at once recognizable by the bluish- or dark-green color of the foliage, that of *E. polygonifolia* being a paler green. When we crossed the James River Bridge from near Newport News we saw that below the south end of the bridge there was a sand-beach, outside the salt marsh. There, again, was *E. ammannioides*, in the same relation to *E. polygonifolia* as at Yorktown; and in the following days we trailed the two, always in the same relative positions and always quickly distinguished by color, along the sand-beaches of the James up-river into Surry County. *Euphorbia ammannioides*, although tropical, is surely at home in Virginia.

[1] Some years ago a prominent German botanist, finding, upon reaching Harvard Square, almost no one who could help him, eventually discovered a taxi-driver who had taken me to the Gray Herbarium. "Why", he said upon reaching his destination, "everyone in Germany knows the Gray Herbarium".

One point was very clear. Whereas up-river all streams were at freshet-pitch, the broad estuary of the James, confluent with Chesapeake Bay, had quickly disposed of the surplus; the beaches and tidal reaches of the lower James were available for exploration and *Euphorbia ammannioides* indicated real discoveries to be made. Before concentrating on a programme so suddenly conceived we had to do what we could with some already known areas. The road to Emporia was open; so we could follow up problems in that direction, but we at once found that the Nottoway was still on the rampage. I have referred to the occurrence of the isolated colony of *Vicia grandiflora* by a woodland path northwest of Emporia. At the border of the same woods, on one side of Three Creek, the still pretty local Asiatic *Arthraxon hispidus* (Thunb.) Makino, var. *cryptatherus* (Hackel) Honda, abounds; across the Creek, the woods are bordered by the tropical Asiatic *Eulalia viminea* (Trin.) Kuntze, a decidedly local adventive. Below Double Bridge it was impossible to approach the Nottoway. A mile away from the river a dislodged wooden bridge was poised in the branches of forest-trees and plants beginning to be uncovered by receding waters were unrecognizable, crisp and black. The still unidentified *Aconitum* was intact, however, but, as already noted, with little promise of ever flowering.

At Chub, as soon as the river had somewhat receded, the whole area became a breeding haunt for mosquitoes. With heads as much veiled as possible we fought our way through their devouring hordes and soon found in the sand a sedge quite new to our field-experience, another southern plant not previously known in the state, *Bulbostylis coarctatus* (Ell.) Fernald. At first happy to collect midgets a few inches high, we soon became selective and would touch nothing which would fill less than the length of the herbarium-sheet; and a few days later we again found this fine species, this time east of Cypress Bridge in Southampton. *Lespedeza* here was perplexing; it always is. In Part II I shall discuss and illustrate some of the complexities of the genus, but there are others still unsolved. At the border of the hickory and oak woods already noted, where *Sanicula marilandica*, *Hexalectris*, *Psoralea canescens* and *Scrophularia lanceolata* occur, we found our first

Chenopodium Boscianaum. For a plant originally collected in the Southeast it is remarkably local in eastern Virginia; in New England it is far more common. In the sandy border of a thicket *Centrosema virginianum* was heavily flowering. Since we are inclined to pass this showy plant as not important to collect, I here relented a little and suggested taking just two plants, one apiece, to show complete root-systems. This we did, and upon labeling the material months later it became evident that we had unwittingly got the southern extreme which was described by DeCandolle as *Clitoria virginiana, β. elliptica.* This is its first collection from north of South Carolina. In fact "the first from north of South Carolina" is the key-note to botanizing in the region of Chub. Nevertheless, in dry sand only a little to the south the boreal *Lycopodium tristachyum* (Newfoundland to the Lake Superior region, south to the mountains of North Carolina) forms the largest and healthiest carpet either Long or I had ever seen!

Worried concerning the fate of the unidentified pondweed in the outlet of Lee's Millpond, we soon went there. Ordinarily it would be about 60 miles by road but, since we could nowhere cross the Blackwater and much of Franklin, on the west bank of the river, was still afloat, we were forced to go 100 miles around to get there. Nothing which could be identified by the most acute student of fossil peat remained; the outlet-stream, with its mat of floating aquatics, was a deep trough of bare mud. Proceeding toward the pine barrens to the south we soon found the road at the foot of one slope wholly submerged. The Blackwater was still chiefly a back-water. Eventually reaching portions of the pine-barren area, we found *Carphephorus tomentosus,* var. *Walteri* (Ell.) Fern. and *Andropogon virginicus,* var. *glaucus* (Muhl.) Hack. (*A. capillipes* Nash), both new to the county, in great abundance. *Symplocos tinctoria* was represented by a dwarf shrub, sometimes only a foot high, with very small yellowish leaves. The late Judge Churchill once got the same dwarf near Norfolk. It seems to be worth varietal recognition. *Juncus abortivus* Chapm. was everywhere abundant, while *Asimina parviflora* and *Cleistes divaricata* (L.) Ames, also new to the county, were scattered.

Having cleared off the problems held over from preceding

trips, we now started for the lower James; and the farther east of the Piedmont we went the nearer to the Blue Ridge and the Shenandoah Valley we seemed to be, until at the farthest point eastward which we reached, the rapidly disintegrating Miocene bluffs below old Fort Boykin (north of Smithfield), we were getting our first Coastal Plain collection of the northern and inland *Celastrus scandens;* while here *Campanula americana* (MAP 7) and *Lobelia siphilitica*, wide-ranging upland and inland species, were as abundant as farther up the James or as in the mountains, and *Thaspium barbinode* here attained a height well over three feet. We visited the shores or woodlands near the James at seven stations in Surry and Isle of Wight Counties and everywhere the continental and montane species outnumbered those of the Coastal Plain. This, of course, is due to the highly calcareous Miocene fossil-beds here at the surface, where inland as well as coastwise calcicolous types have every encouragement to growth.

The westernmost area examined was slightly above Claremont, where deep ravines have been cut by small streams entering the James. We already knew, slightly east of our present ravines, fine colonies of such localized specialties as *Athyrium thelypterioides* (Michx.) Desv. (the largest we ever saw), *Carex Jamesii, Hybanthus concolor, Euonymus atropurpureus, Aralia racemosa, Stachys Nuttallii* and scores of other calcicoles of the uplands; but, starting upon a new ravine, we gave a real shout when we promptly walked into a carpet of *Athyrium pycnocarpon* (Spreng.) Tidestrom. That surely was one of the last ferns to be expected on the Coastal Plain. *Ponthieva racemosa* (Walt.) Mohr was, of course, here, as at other such places in the county, and *Pedicularis lanceolata* and *Aster infirmus* we had occasionally found before, farther west; but when we came upon colonies of the orange- to vermilion-lipped *Malaxis floridana* (Chapm.) Kuntze, almost at its northern limit, and, while following up its several scattered patches, came upon clumps of upland *Triphora trianthophora* (Sw.) Rydb., nearer the southeastern border of its range, we had difficulty in restraining our joy. For seven years we had sought in vain the southern *Eupatorium incarnatum*, long ago reported from Virginia. Here it was; and with it the northern and inland *Desmodium bracteosum*

(Michx.) DC., new to the Coastal Plain list. On a drier slope, with *Cunila origanoides,* which we had known on the Coastal Plain only at a point 35 miles to the southwest, in Southampton County, there was a colony of *Arabis canadensis* (Maine to Minnesota, south to the Blue Ridge and Alleghenies of Virginia, thence to the mountains of Georgia, etc.). We ought to have been satisfied; but, looking along the spring-fed bottom, where in May we had got the northern and montane *Carex prasina* and where the leaves of *Senecio aureus* reached a diameter of 9 inches (!), we had a new thrill. There was unmistakable *Senecio Crawfordii* Britton, the local species of southeastern Pennsylvania and adjacent region, with its previous authenticated southern limit in Prince George County, Maryland. It is useless to deny that Claremont is a rich botanical center. We always make discoveries there and only a few limited spots in the region have yet been touched.

Along the western end of Cobham Bay, as at Scotland for instance, the famous fossiliferous bluffs of the James are so indurated as to support only a tediously uninspiring living flora, although the paleontologists apparently give the Scotland bluffs superior rank. Consequently, when, desiring to get at sandy beaches on the James, we put the proposition to Frank, we were not over-enthusiastic as he told us of a sand-beach on Cobham Bay. When we got there, however, slightly to the west of Chippokes, one day would not suffice; we came again next day. The steep wooded bluffs have a fine forest, with Hop Hornbeam, Slippery Elm and other trees of rich upland prevailing, and at the bases of the slopes or in the thicket back of the beach the upland vegetation was highly developed, with *Equisetum arvense* here largely represented by the gigantic extreme with forking and reforking branches, forma *pseudosylvaticum* (Milde) Luerss., which, judging from the 2 sheets accumulated by Alvah Eaton, is a very unusual plant. Many upland species already known along the river, *Stachys Nuttallii* and others, would have thrilled us if we had first come to the lower James at this point. They need not be mentioned here; but typical *Eupatorium sessilifolium* was our first from the Coastal Plain, although we had now become somewhat hardened to *E. sessilifolium,* var. *Vaseyi* (Porter) Fern. & Griscom. And

on the sands, at the farthest point up-river we have yet found it, was the long-sought *Euphorbia ammannioides,* from here down-river afterward pretty generally seen. Here, too, was the inland limit on the James for *Diplachne maritima* Bicknell, which we had previously seen only about Back Bay; and *Lythrum lineare* we know only slightly farther inland.

Cobham Bay is separated from Burwell's Bay, farther down-river, by a point, to the north of Bacon's Castle, which ends in a great flat of sands and marsh-land, Hog Island. It was here that the original proprietor kept his hogs early in the 17th century, and it was appropriate that, crossing the creek to Hog Island, we should immediately hear the unmistakable squealing of hogs. These and cattle have full control of the place but the genial owner gave us permission to share the vegetation with them. In some marshy spots, fenced off from invasion, as too soft and dangerous for heavy animals with sharp hoofs, we established new inland limits for maritime types: *Distichlis spicata, Spartina alterniflora* var. *glabra, Eleocharis parvula, Juncus Roemerianus* and *Sabatia stellaris* (with the white-flowered form abundant). This was all most interesting but we were still more pleased with shallow pools solidly filled with *Ammannia Koehnei,* var. *exauriculata* Fernald, for this variety of a relatively rare species had been known only as an endemic of the marshes of North Landing River in Norfolk County. Three to four centuries of occupation by cattle and swine of flat and steaming Hog Island, with almost tropical heat and plenty of open woods and thickets, had greatly encouraged ticks. We never imagined so many; and when we got back to the car and found poor Frank stripped and desparately extracting the hundreds of peppery little seed-ticks which had got him and had instantly burrowed in, we were ready to leave. Frank's clothes were safely concealed under a closed cover, to be fumigated on the return home, and he was forced to drive all the way back to Petersburg, girdled in a string and a loin-cloth devised from a small piece of balloon-silk which I used as a shoulder-cape during thunder-showers. Luckily we had no encounters with the police on the way. Hog Island has some obvious disadvantages.

The broad sweep of Burwell's Bay, from above old Mac-

kimmie's Wharf to Day's Point below old Fort Boykin, has its chief village a little back from the western shore, Rushmere, called on the contour-sheets of 1907 Fergusson's Wharf (a name almost forgotten, while the settlement near old Mackimmie's Wharf is now Bailey's Beach). We tried the shore at three points: at Bailey's Beach (Mackimmie's Wharf), at Rushmere, and below Rushmere at a beach-resort which has now monopolized the name Burwell's Bay. If you ask for Burwell's Bay, the native, from Smithfield to Surry, thinks of this resort rather than of the 7-mile sweeping arc in the south shore of the James. Alternating bluffs and depressions are back of the sand-beach. The depressions are chiefly cypress- and gum-swamps, often with bayou-like forking pools of black water. The bluffs are steep, all fossiliferous and with broad hard bands, ragged with the solidified shells of giant Miocene mollusks, shark-skeletons and other sharp protuberances, alternating with other broad bands of soft and seeping or oozing white shell-bearing marls, with the shells soft and disintegrating, the springs bubbling out at all heights, from crests at 30 to 60 feet above the river or from the bases of steep slopes back of the beach. The forest was largely of the richest upland type, with a grand mixture of the commoner inland species interspersed with *Juglans cinerea, Quercus montana, Ostrya virginiana, Acer floridanum* Pax, and *Tilia heterophylla.* These are not Coastal Plain types; but the abundance of the fiercely armored Hercules'-club, *Zanthoxylum Clava-Herculis* (Florida to Texas, north to southeastern Virginia and Arkansas) back of the beach, there associated with *Bumelia lycioides,* var. *virginiana* Fernald (lower James to Cape Henry), the carpets on the sand of the coastal *Euphorbia ammannioides* again, with the coastal *Diodia teres,* var. *hystricina* Fernald & Griscom (Cape Charles and Cape Henry), and the abundance at the bases of the seeping bluffs of the coastwise (tropical America, north to eastern Virginia) *Verbena scabra* Vahl—these convinced us that we had not been set down in the Shenandoah Valley or on the slopes of the Alleghenies. Vegetation was rank: *Equisetum hyemale,* var. *affine* nearly 6½ feet high; the annual *Impatiens biflora* 8 feet high, with trunks 2–3 inches in diameter; *Hydrangea arborescens* with leaves sometimes nearly 6 inches broad and cymes more than

7 inches across. We took many species for record of extreme size and were occupied with this innocuous diversion when suddenly, in the deep crannies of a fallen and very ragged chunk of a sheer cliff we detected *Pellaea atropurpurea!* Long went back through the tangle of lianes (*Decumaria* and *Berchemia* tangled with *Menispermum, Rhus radicans* and *Smilax hispida,* made navigable by sprangling brambles 12 or 15 feet high) and found the sheer hard cliff closely covered with gigantic *Pellaea.* That, again, is not a Coastal Plain type.

Where the bluffs consist of soaking-wet slippery marl the northern and inland *Epilobium coloratum* was tall and of shrubby aspect (a fragment of a lateral branch fills a sheet) and the coastal *Polypogon monspeliensis,* lopping its old panicles into the seepage, where the grains had all germinated, was fantastic with its miniature terminal lawns of young seedlings! In such habitats an *Erigeron,* relatively small on drier ledges, was producing basal rosettes with crisply brittle and fleshy, smooth leaves up to a foot long and 4 inches broad; and its old and shrivelled stems, in late August, often lopped over into perpetually springy paste, were taking root at the upper nodes and there producing new rosettes with fresh flowering stems. This was a most novel plant, with abundant white rays; and when, in June of the current year, we found it everywhere characteristic of the springy and seeping bluffs from below Fort Boykin, in Isle of Wight, nearly to Sunken Meadow Beach in Surry, and in September on the marl-bluffs of Claremont, it became evident that these unique calcareous walls along the lower James support a unique and endomic species of *Erigeron.* This will be further discussed and illustrated (PLATE 695) in Part II.

Vitis was a hopeless tangle. All the regular species of eastern Virginia there abound, with *V. aestivalis* mostly represented by the northern and upland var. *argentifolia* (*V. bicolor* of most authors). Others are precariously close to *V. Baileyana* (western Virginia, westward and southwestward) and sprouts, where fire had run, were perplexing, with deeply cleft leaves, the middle lobe strongly constricted near the base, the veins of the lower surface copiously hirsute. This was a puzzle but Long insisted that it was ordinary *V. vulpina* (*V. cordifolia*),

which has essentially unlobed long-pointed and glabrous foliage. As usual, he was right. In June of the present year I found these long sprouts with much dissected hirsute-veined leaves coming from the base of a large vine. Pulling it down from the trees above, there it was, with foliage of the flowering branches uncleft, rounded, long-acuminate and glabrous, typical *V. vulpina.* Ho, hum!

When, snatching a few minutes for lunch, we spread a cloth in the shade near the summer-cottages, we found that the broad carpet all around was a great mat of the Old World *Potentilla reptans,* a relatively rare species in America and not, I think, recorded from Virginia. At this station it makes a continuous carpet in the cleared and settled area, although, as we found last June, sharing the ground with other local adventives.

Below the bluffs there is a broad sand-beach (very weedy with ubiquitous *Saponaria, Melilotus,* etc.) and back of the beach a swamp of cypress, gum and other paludal trees. In the thicket between the beach and the swamp many fine species prevail; best of those, not already known from along the lower James, is *Eupatorium altissimum,* another montane species. In the edge of the wooded swamp I picked up a single specimen of *Malaxis floridana* which, the day before, we had seen in some quantity farther west. There must be more but we did not see it. *Sabatia calycina,* the first seen so far north as the James, and *Echinodorus radicans,* also new to our list of James River plants, were here; while the wonderful pink flowers of *Kosteletzkya virginica,* with a spread of 2½ inches, were so much larger than those of New Jersey and Long Island that in Part II I shall attempt a clarification of the group. The great excitement here, however, was caused by the big clumps of a tall and arching *Carex,* with flexuous panicles shattered but still handsome. We got it again in the cypress swamp back of Bailey's Beach, and in June of this year fresh and sumptuous material shows conclusively that it is one of the rarest of sedges, *Carex decomposita.* Singularly few sheets exist in the Gray Herbarium showing actual localities; they are mostly of specimens collected before 1870, the single or rare old vouchers with only the state indicated: duplicating sheets from Penn Yan or Junius or Ontario County, in western New York, all nearly

a century old; more modern ones from near Great Falls on the Potomac in Maryland; old specimens marked simply "Florida, *Chapman*"; others, as vague, from "Ohio, *Sullivant*" and "Michigan Territory, June 1832, *Folwell*"; one, with modern data, from Edmonson County, Kentucky, *Svenson;* one from *F. L. Harvey* with no further information than "New to my collection of Ark[ansas] plants. Only this specimen seen"; one from Lawrence County, Alabama, June 26, 1867, *T. M. Peters;* and the usual indefinite sheets from "Louisiana, *Hale*". Two others from the Southeast have good data and are significant because Mackenzie (N. Am. Fl.) excluded both these states from the range: 1 mile southwest of Williamsburg, Virginia, *Grimes;* base of cypress-tree, Greenfield Lake at Wilmington, North Carolina, *Godfrey & Wells*. From such data it is impossible to make a satisfactory map, and state floras regularly indicate the great rarity or early extermination of the plant. In Isle of Wight County material for all herbaria can be easily secured!

I must here content myself with mention of only one more plant. Spanish Moss, *Tillandsia usneoides*, had been known to us in Virginia only in eastern Princess Anne County and near Eastville on the Eastern Shore. It was, consequently, a great surprise, looking up from caring for *Carex decomposita*, to see the familiar balls hanging from branches overhead. They were quite beyond reach, but by balancing on a slumpy knoll and reaching up with a long branch, Long, after many efforts, succeeded in twisting off a few fragments—enough to establish the record of *Tillandsia* up the James to Isle of Wight (nearly to Surry).

We needed fresh material of one of the tidal plants of the Mattaponi to complete a record published a year ago. We thought we had sufficiently explored these fresh tidal shores in the autumn of 1939, but, returning to the region of King William Courthouse, we found that one of the supposedly rare species of *Bacopa*, which, in 1939, we had found so extremely scattered that we spent back-breaking hours in assembling a few sheets of meagre specimens, now formed carpets here, farther up-river and across the Mattaponi in King and Queen County. It was a simple matter to lift mats which cover quarter of the area of a standard herbarium-sheet. I thought I knew what it was,

but in August and September of the current year its abundance in equally extensive carpets along the Chickahominy, where it associates with other members of its affinity, raises new questions of identity, so that the solution must be held over until thorough study of the series can be undertaken. This should have satisfied us; but a tall *Echinochloa* with lax and open flexuous panicles up to a foot or more long, the spikelets nearly smooth, the long leaves membranous, was everywhere in the estuary, the culms floating at high tide or the panicles becoming submerged. This was something quite new to us. It seems to be the tropical American *E. crus-pavonis* (HBK.) Schultes, its northern recorded limit almost 800 miles away, in southern Alabama. As if that were not enough, for an estuary already "worked out", *Najas* at low tide began to upset our calculations. The material secured belongs to three species. Before they can be satisfactorily settled additional collections, especially at a later season, must be secured. They illustrate again the complexity of the flora of southeastern Virginia and emphasize, as I shall doubtless repeat until the end: there is plenty to do; there are few thoroughly prepared to do it.

Part II. Range-extensions, technical Notes and Revisions

In Part II I have assembled, mostly in briefer form for quick reference, the principal records of range-extensions found in the preceding diffuse narrative. With them are some not there noted. Several revisions of groups found in eastern Virginia are included, though the study of *Rhus aromatica*, not growing directly out of our field-work, is here published that it may be associated with the discussion of *R. Toxicodendron* and *R. radicans*, based largely upon Virginian experiences. A few records not our own are also added, since they pertain to the region, southeastern tidewater Virginia, primarily studied. As noted at the opening of the paper, we were helped through a grant to the author from the Penrose Fund of the American Philosophical Society. This grant, for which I am deeply grateful, covered the expenses of automobile and boats as well as the employment of an efficient helper through the season. The original photographs for illustration were made chiefly by Dr. Walter H. Hodge, while a teaching fellow in the Laboratory of

Systematic Botany at the Gray Herbarium. Their cost and that of the engraver's blocks has been defrayed through an appropriation for personal research from the Department of Biology of Harvard University. Their reproduction has, with his customary generosity, been made possible through aid from Mr. Long. In the citation of specimens (except in new descriptions or in revisions) the names of the collectors, *Fernald & Long*, are omitted. Plants thought to be unrecorded as members of the flora of the state are indicated by an asterisk (*).

Dryopteris cristata (L.) Gray. To the very few known stations in Tidewater Virginia add one in Southampton County: low sandy woods along Wakefield Road, northeast of Sebrell, no. 11,921, a small and highly localized colony. See p. 492.

Athyrium pycnocarpon (Spreng.) Tidestrom. Surry County: bottom of rich calcareous wooded ravine west of Claremont, no. 12,512, one extensive colony. See p. 520.

Our only Coastal Plain station.

Pellaea atropurpurea (L.) Link. Isle of Wight County: dry cliff and loosened boulders of calcareous conglomerate by Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), nos. 12,513 and 12,514, an extensive colony. See p. 524.

Our only Coastal Plain station.

*Equisetum arvense L., forma pseudosylvaticum (Milde) Luerss. Surry County: wooded calcareous slopes by Cobham Bay, James River, northwest of Chippokes, no. 12,515, large plants, with branches spreading 2 dm. from the main axis.

The material in the Gray Herbarium shows none of this form from so far south as Virginia. See p. 521.

E. hyemale L., var. affine (Engelm.) A. A. Eaton. Isle of Wight County: rich calcareous wooded slopes by Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,516, stems up to 1.95 m. high. See p. 523.

Potamogeton pusillus L. (*P. panormitanus* Biv.). New Kent County: fresh tidal marsh by Chickahominy River, at "Shady Rest", southeast of Windsor Shades (Boulevard Postoffice), no. 12,527. Surry County: tidal pools, Hog Island, no. 12,525. Princess Anne County: sand-bottomed shallow ponds, Cedar Island, no. 12,232. See p. 513.

Extension south from the Potomac.

*P. Berchtoldi Fieber, var. tenuissimus (Mert. & Koch) Fernald (*P. pusillus*, var.). Sussex County: in water at mar-

gin of Chappell's Millpond (Honey Pond), west of Lumberton, no. 12,236. See p. 508.

Extension south from New Jersey and Pennsylvania.

P. SPIRILLUS Tuckerm. To the station in New Kent County add one in KING WILLIAM COUNTY: fresh tidal margin of Mattaponi River, northwest of King William Courthouse, no. 12,526.

P. EPIHYDRUS Raf., var. NUTTALLII (C. & S.) Fernald. To the station in New Kent County add one in ISLE OF WIGHT COUNTY: outlet of Lee's Millpond, no. 12,231. See p. 508.

ECHINODORUS RADICANS (Nutt.) Engelm. Local range extended north from Southampton County. SUSSEX COUNTY: in water at margin of Chappell's Millpond (Honey Pond), west of Lumberton, no. 12,237. ISLE OF WIGHT COUNTY: cypress and gum swamp back of the beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,531. See pp. 508 and 525.

LIMNOBIUM SPONGIA (Bosc) Richard. An additional station in PRINCESS ANNE COUNTY: shallow water, inlet to Rainey Pond, back of Sand Bridge, no. 12,238. See p. 512.

BROMUS CATHARTICUS Vahl. HENRICO COUNTY: waste places and roadsides, Richmond, no. 11,931. DINWIDDIE COUNTY: waste ground and cinders of freight-yard of Atlantic Coast Line, Petersburg, no. 11,930. See pp. 492 and 493.

B. PURGANS L. YORK COUNTY: rich wooded ravine by York River, above Yorktown, no. 11,936. PRINCE GEORGE COUNTY to ISLE OF WIGHT COUNTY: common along the James (many nos.).

*B. JAPONICUS Thunb., var. PORRECTUS Hackel in Magyar Bot. Lapok, ii. 58 (1903). Common in waste ground (many nos.).

Bromus japonicus has been reported from Virginia, and Hitchcock (Man.) maps it as occurring in most states from New England to the Pacific, south to North Carolina, Tennessee, Arkansas and Texas. His illustration (fig. 43) and description, with "awn . . . somewhat twisted and strongly flexuous at maturity" do not agree, however, with the bulk of eastern specimens. They do agree with Thunberg's original diagnosis "aristis divaricatis" and with *B. japonicus*, var. *typicus* Hackel, l. c. In the small representation in the Gray Herbarium the only specimen of var. *typicus* (with divergent awn) from the Atlantic States is one *cultivated* at the Department of Agriculture in Washington in 1895, though the herbarium of the New England Botanical Club contains ballast-land specimens

collected in Boston in 1879 and a sheet from mill-waste in Connecticut collected in 1912. The others are from Michigan, Iowa, Missouri, Nebraska, Alberta and Washington. All other material in the Gray Herbarium from the Atlantic States is of var. *porrectus*, with awns directed straight forward. It is surmised that the Virginia record (and those from many other states) was really based on var. *porrectus*.

*Bromus (§ Zerna) **nottowayanus**, sp. nov. (tab. 670, fig. 1–7), culmis 0.6–1.5 m. altis; foliis caulinis 6–8, vaginis nodos plerumque superantibus imis mediisque retrorso-villosis; laminis 0.6–1.3 cm. latis paginis superioribus pilosis, inferioribus glabris vel ad costam hirsutis, basi rotundatis ligula brevi; paniculis nutantibus 0.5–2 dm. longis ramis flexuosis pulvinis vix crassis; spiculis 1.8–4 cm. longis 3–11-floris; gluma inferiore 1–3-nervia, superiore 5–7-nervia; lemmatibus dorso strigoso-pilosis 8–13 mm. longis; aristis 5–8 mm. longis; palea dorso pilosa apice plana.—Valley of Nottoway River, Sussex and Greensville Counties, Virginia: Sussex County: border of dry sandy woods, 4 miles south of Stony Creek, August 19, 1936, *Fernald, Griscom & Long*, no. 6519 (distrib. as *B. purgans* L.); bottomland woods along Nottoway River, east of Huske, July 14, 1940, *Fernald & Long*, no. 12,239 (type in Herb. Gray; isotype in Herb. Phil. Acad.), also June 13, 1941 (young panicles beginning to show), no. 12,927; border of woods near Nottoway River, Green Church Bridge, northwest of Owen's Store, July 14, 1940, *Fernald & Long*, no. 12,240. Greensville County: argillaceous clearing in swampy woods near Readjuster Bridge over Nottoway River, northeast of Orion (gigantic plants with unusual number of exposed nodes, growing in rich and recently burned land), July 14, 1940, *Fernald & Long*, no. 12,241; rich woods along brook entering Nottoway River below Double Bridge, north of Orion, August 21, 1940, no. 12,537; bottomland woods, Nottoway River, north of Orion, September 14, 1941, no. 13,520 (ripe fruit). See pp. 509 and 510.

As noted, our first collection was distributed as *Bromus purgans* L.; but *B. nottowayanus* is technically nearer the more northern and inland *B. latiglumis* (Shear) Hitchcock (*B. altissimus* Pursh, not Gilib.). In *B. purgans* the nodes more generally overtop the leaf-sheaths; the ligule is prolonged beyond the junction (fig. 8) of sheath and blade; the branches of the panicle have strongly thickened pulvini (fig. 9); the first glume is 1-nerved, the second 3-nerved; the lemmas are tightly inrolled (fig. 10) and more pilose at base than above, or quite glabrous in forma

glabriflorus Wieg.; and the palea is pulverulent on the back or only occasionally pilose. In *B. nottowayanus,* on the other hand, the lower and middle and usually all but the uppermost nodes are overtopped by the sheaths; the ligule is very short or scarcely visible above the rounded summit of the sheath (FIG. 2); the 1st glume is 1–3 nerved, the 2nd 5 (rarely 7)-nerved (FIGS. 5 and 6); the lemmas (FIGS. 4 and 5) are evenly strigose-pilose over the back, their margins scarcely incurved; and the palea (FIG 7) is copiously pilose on the back.

In its prolonged sheaths and in its lemmas scarcely inrolled at margin *Bromus nottowayanus* is similar to *B. latiglumis;* but the two differ in many points. *B. latiglumis* has 10–20 cauline leaves; *B. nottowayanus* only 6–8. The base of the blade just above the junction with the sheath of *B. latiglumis* expands into a characteristic broad flange with a prolonged projection on each side (FIG. 11); *B. nottowayanus* has no such flange at the base of the blade (FIG. 2). The bases of the panicle-branches in *B. latiglumis* have very large pulvini (FIG. 12), those of *B. nottowayanus* (FIG. 3) being relatively slender. In *B. latiglumis* the 1st glume is 1-nerved, the 2nd 3-nerved; in *B. nottowayanus* 3-nerved and 5 (or 7)-nerved respectively. In *B. latiglumis* the lemmas are glabrous, or pubescent particularly at base; in *B. nottowayanus* evenly strigose-pilose all over. In *B. latiglumis* the palea is sometimes pilose but more often glabrous on the back; in *B. nottowayanus* apparently always pilose.

Bromus purgans is a relatively early-flowering species, *B. latiglumis* much later, *B. nottowayanus* intermediate between them in time of anthesis. The flowering material of the latter was collected in July, with belated culms flowering in August. In New England and New York *B. purgans* flowers from mid-June to mid-July, in Virginia from late May through June. In New England, New York, New Jersey and Pennsylvania *B. latiglumis* flowers from August 10 to mid-September; from Ohio and West Virginia westward, from mid-August to late September.

In PLATE 670, FIGS. 1–7 are of BROMUS NOTTOWAYANUS Fernald, all figures from the TYPE; FIG. 1, the TYPE, × ⅔; FIG. 2, summit of sheath, × 4; FIG. 3, bases of branches of panicle, × 4; FIG. 4, spikelet, × 2; FIG. 5, glumes and base of lowest lemma, × 4; FIG. 6, inner face of 2nd glume, × 4; FIG. 7, floret, with palea exposed, × 4. FIGS. 8–10, B. PURGANS L.: FIG. 8, summit of sheath

(with ligule), × 4, from Milton, Massachusetts, July 31, 1899, *Kennedy;* fig. 9, bases of panicle-branches, × 4, from Lansing, New York, *A. J. Eames,* no. 11,378; fig. 10, portion of spikelet, showing inrolled lemmas, × 2, from no. 11,378. Figs. 11–13, B. latiglumis (Scribn.) Hitchc.: fig. 11, summit of sheath, × 4, from Beau Lac, St. Francis River, Maine, August 14, 1902, *Eggleston & Fernald;* fig. 12, bases of panicle-branches, × 4, from Sheffield, Massachusetts, August 14, 1920, *Churchill;* fig. 13, spikelet, × 2, from Ithaca, New York, *F. P. Metcalf,* no. 5828.

B. sterilis L. Dinwiddie County: waste ground and cinders of freight-yard of Atlantic Coast Line, Petersburg, no. 11,935. See p. 493.

Poa bulbosa L. Dinwiddie County: dry roadside and dooryard, Century House, northeast of Burgess, no. 11,743. Our only station.

Distichlis spicata (L.) Greene. Extending up the James to Surry County: fresh to brackish tidal marshes, Hog Island, no. 12,538. See p. 522.

Diplachne maritima Bicknell. Extending up the James to Surry County: fresh to brackish tidal marshes, Hog Island, no. 12,541; tidal marsh by Cobham Bay, James River, northwest of Chippokes, no. 12,540. See p. 522.

*Elymus virginicus L., var. halophilus (Bicknell) Bush. Princess Anne County: marshes back of the dunes, Sand Bridge, no. 12,246.

Extension south from New Jersey. See p. 512.

*Lolium multiflorum Lam., forma submuticum (Mut.) Hayek. Henrico County: waste places and railroad ballast, Richmond, no. 12,251.

Sphenopholis obtusata (Michx.) Scribn.

In eastern Virginia *Sphenopholis obtusata* occurs in three somewhat definite variations. These are clearly confluent but they have all been treated by competent students of grasses as three distinct species, by others (Hitchcock, Man.) as not worthy recognition even as forms. In sorting the material in the Gray Herbarium certain trends come to light, however, which indicate that each of the three has an area of geographic concentration and that in large areas of the United States one of them abounds to the exclusion or near exclusion of one or both of the others. I am, therefore, returning to Scribner's treatment of 1908[1] when he called them three varieties. I distinguish the three as follows.

[1] Scribner in Robinson in Rhodora, x. 65 (1908).

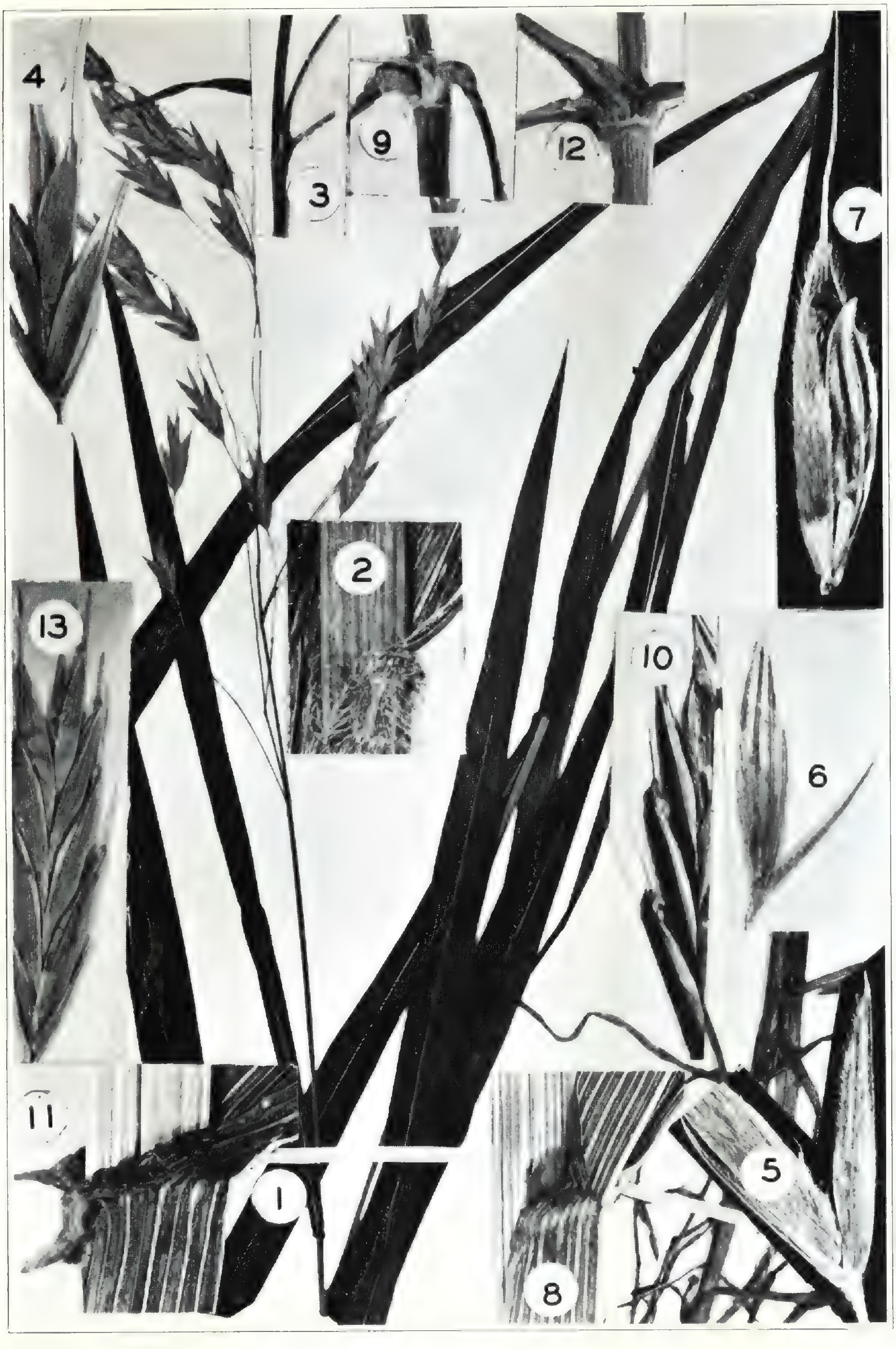


Photo. W. H. Hodge.

Bromus nottowayanus: fig. 1, habit, × ⅔; fig. 2, summit of sheath, × 4; fig. 3, bases of panicle-branches, × 4; fig. 4, spikelet, × 2; fig. 5, glumes and base of lemma, × 4; fig. 6, inner face of 2d glume, × 4; fig. 7, lemma and palea, × 4.

B. purgans: fig. 8, summit of sheath, × 4; fig. 9, bases of panicle-branches, × 4; fig. 10, inrolled lemmas, × 4.

B. latiglumis: fig. 11, summit of sheath, × 4; fig. 12, bases of panicle-branches, × 4; fig. 13, spikelet, × 2.

a. Panicle 0.7–2 dm. long, up to 3 cm. thick, its branches irregularly elongate and not strongly appressed and rounded at summit.
Leaves or their sheaths glabrous or merely scabrous .... *S. obtusata* (typical).
Leaves or their sheaths pilose........................Var. *pubescens.*
a. Panicle 0.3–1 (–1.3) dm. long, 0.5–1.5 cm. thick, its tightly appressed branches essentially uniform and strongly rounded; sheaths puberulent.......................... Var. *lobata.*

Taking as a check the representation in the Gray Herbarium, where, with no specialization upon the grasses, the average run of collections has accumulated, I note the following trends. Typical *Sphenopholis obtusata* is irregularly dispersed over the eastern half of the United States, from Maine to southern Ontario, Minnesota and eastern Nebraska southward. There are no specimens from the Cordilleran region (Alberta to New Mexico and westward), while from Virginia to Georgia there are only 10 specimens as against 27 from New England to North Dakota, Nebraska and eastern Kansas. Var. *pubescens* is not at all represented from northern New England westward, but from southern New England southward to Florida, thence to Louisiana and Missouri, there are 38 sheets, this variety showing a concentration on the Coastal Plain and outer Piedmont. Var. *lobata* has the broadest range, but it is the only variety represented from Alberta to New Mexico, thence west to the Pacific (27 sheets), with marked development from North Dakota to Oklahoma and northeast to northern New England (31 sheets as against 0 of var. *pubescens*). From the Coastal Plain area, whence var. *pubescens* is represented by 38 sheets, var. *lobata* shows only 8. If other herbaria were studied these figures would be greatly increased, but it is doubtful if their trend would be greatly changed.

In southeastern Virginia all three varieties occur.

*Sphenopholis obtusata (Michx.) Scribn. (typical): Dinwiddie County: waste ground and cinders of freight-yard of Atlantic Coast Line, Petersburg, no. 11,946. Presumably an adventive. See p. 493.

S. obtusata, var. pubescens (Scribn. & Merr.) Scribn. (*Eatonia pubescens* Scribn. & Merr.). Many nos. from Accomac, Henrico, Norfolk and Greensville Counties. Old specimens from Richmond and from Bedford County annotated by Scribner, with the comment that "This is the more common form of *Eatonia obtusata* in the South." See p. 493.

*S. obtusata, var. lobata (Trin.) Scribn. (*Trisetum lobatum* Trin.) Princess Anne County: swale by Nowney Creek, Back Bay, no. 4552. Isle of Wight County: thickets and open woods back of the beach of James River west of Fort Boykin, no. 12,933. Sussex County: clearings, borders of dry woods and roadsides east of Stony Creek, no. 8047..

*S. filiformis (Chapm.) Scribn. Nansemond County: white sand of pine and oak woods and clearings near Cathole Landing, west of Factory Hill, no. 11,747.

First from north of North Carolina. See p. 490.

*S. pallens (Spreng.) Scribn. Southampton County: rich wooded slopes and spring-heads along Nottoway River, above Carey Bridge, no. 11,945.

First except for an indefinite station in South Carolina and the unidentified station for the type. See p. 494; also Rhodora, xlii. 357 (1940).

Aira praecox L. Surry County: weed in lawn, Surry Courthouse, no. 11,749. Princess Anne County: sandy open ground near sea, Virginia Beach, *B. L. Robinson*, no. 424.

Certainly a local plant in Virginia. See p. 488.

A. caryophyllea L. Norfolk County: Norfolk, *Heller*, no. 857. Dinwiddie County: dry pastured field east of Burgess Station, no. 11,947.

Much less common than *A. capillaris* Host. Several collections of the latter have unfortunately been distributed as *A. caryophyllea*, this misidentification resulting, in part, from the statement by Hitchcock in Gray's Man. ed. 7, that the spikelets of *A. capillaris* are "2.5 mm. long". Measurements of spikelets and reference to European descriptions indicate that they are 1.5– rarely 2 mm. in length, while those of *A. caryophyllea* range from 2.5 to 3 mm.

Polypogon monspeliensis (L.) Desv. Range extended up the James to Isle of Wight County: seeping argillaceous and calcareous bluffs along Burwell Bay, below Rushmere (Fergusson's Wharf), no. 12,547. See p. 524.

*Agrostis stolonifera L. Isle of Wight County: open bushy margin of Lee's Millpond, no. 12,252. Nansemond County: roadside bank south of Nurney, no. 12,936. Seen in several other counties.

Not recorded by Hitchcock (Man.) from south of New Jersey.

*A. STOLONIFERA, var. COMPACTA Hartm. (*A. palustris* Huds., *A. maritima* Lam.). SURRY COUNTY: sandy tidal shore of Crouch Creek, east of Scotland, no. 8547.

First from south of Delaware and Maryland.

*A. TENUIS Sibth. PRINCESS ANNE COUNTY: swales back of the dunes, Sand Bridge, no. 4548.

Hitchcock (Man.) says "south to Maryland, West Virginia and Michigan", although his map shows a dot squarely in the center of Virginia and another in western North Carolina. The two southern dots were evidently based upon var. *aristata* (Parn.) Druce, which Hitchcock records as occurring south to North Carolina.

A. ELLIOTTIANA Schultes. Local range extended north to SUSSEX COUNTY: argillaceous fallow field south of Stony Creek, no. 11,750. See p. 491.

ARISTIDA LANOSA Muhl. Inland range extended north into SUSSEX COUNTY: dry white sand of woods and clearings near Chub, no. 12,548.

SPARTINA ALTERNIFLORA Loisel., var. GLABRA (Muhl.) Fern. Extending up the James to SURRY COUNTY: fresh to brackish tidal marshes, Hog Island, no. 12,549. See p. 522.

ZIZANIOPSIS MILIACEA (Michx.) Döll. & Aschers. Extending to the head of tide on the James, in HENRICO COUNTY: margin of a canal, Richmond, no. 11,952. See p. 495.

Late in the season the culms may fork from the upper nodes, producing stout branches (our no. 12,550 from west of Claremont).

*ECHINOCHLOA CRUS-PAVONIS (HBK.) Schultes. Fresh tidal marshes of Mattaponi River, wholly or nearly immersed at high tide. KING AND QUEEN COUNTY: Walkerton, no. 12,557. KING WILLIAM COUNTY: northwest of King William Courthouse, no. 12,556; Horse Landing, near King William Courthouse, no. 12,555. Extension northward from Alabama. See p. 527.

Echinochloa crus-pavonis, an aquatic and very smooth species with flaccid leaves, elongate and loosely open panicle of relatively smoothish spikelets, has been known as a plant of tropical America (South America, West Indies and Mexico). In his *Manual* Hitchcock records it only from "marshes and wet places, often in water, Alabama, southern Texas, and through tropical America at low altitudes." Its abundance in the estuary of

the Mattaponi is another instance of the tropical types persisting, far north of their more continuous areas, in estuaries, a situation discussed in some detail by me in Rhodora, xlii. 504 et seq. (1940). In the Mattaponi *E. crus-pavonis* is isolated by nearly 800 miles from its stations in southern Alabama.

E. Walteri (Pursh) Heller, forma breviseta Fern. & Griscom in Rhodora, xxxvii. 137 (1935). Originally described from North Landing River, Norfolk Co. Now known from Isle of Wight County: brackish marsh along Cypress Creek, Smithfield, no. 8949 (distrib. as *E. Walteri*); border of salt marsh, Ragged Island, northeast of Carrollton, no. 12,561.

With the dense inflorescence of typical *Echinochloa Walteri* but with awns only 3.5–4.5 mm. long (exceptionally with a few longer ones), the panicle green in all three colonies (instead of purple), the sheaths scabrous but scarcely strigose-hispid.

Eulalia viminea (Trin.) Kuntze. To the original Virginian station of Blake at City Point, Prince George County, reported in Rhodora, xxxvi. 420 (1934) add an extensive one in Greensville County: roadside bordering rich woods by Three Creek, northwest of Emporia, no. 12,564. See p. 518.

The City Point station persists but is likely to be exterminated. The new one shows every indication that the plant will spread. City Point is translated in Hitchcock's Manual into "near Richmond"; but Richmond and City Point are in different counties and farther apart than are Washington and Brandywine or the Patuxent River, Rockville, Fairfax or Accotink. We have no evidence that *Eulalia* is in Richmond, where, on account of the record, many hours have been spent in fruitless search for it.

Arthraxon hispidus (Thunb.) Makino, var. cryptatherus (Hackel) Honda. Rapidly spreading; new stations in southern Sussex and Greensville Counties. See p. 518.

Andropogon virginicus L., var. glaucus (Muhl.) Hackel. Range extended northward into Isle of Wight County: moist sandy and peaty pine barrens, south of Lee's Mill, no. 12,568. See p. 519.

*Cyperus refractus Engelm. Southampton County: bushy swales and borders of swampy woods near Blackwater River, Cobb's Wharf, no. 10,957.

An inland species, heretofore known in the upland of Penn-

sylvania, Maryland, District of Columbia and from western North Carolina and Georgia, and westward.

C. Grayii Torr. Occurring only near the coast (on dunes, in dune-hollows, etc., close to the sea) at the northern end of its range (in New England), *C. Grayii* in the South pushes back to the "fall-line sand hills". The inland stations in southeastern Virginia are the following. Isle of Wight County: dry sandy pine barrens south of Zuni, no. 6525; white sand of dry woods and clearings east of Joyner's Bridge, no. 12,265. Nansemond County: white sand of pine barrens, southwest of South Quay, no. 10,136; dry white sand of pine barrens, east of Cox Landing, south of South Quay, no. 10,536; white sand of pine barrens, east of Cherry Grove, south of South Quay, nos. 10,534 and 10,535. Southampton County: white sand of pine and oak woods southeast of Wiggins School, south of Franklin, no. 11,265; dry sand, pine barrens about 7 miles south of Franklin, nos. 7326 (large) and 7326[a] (dwarf); dry white sand in oak and pine woods and clearings bordering Assamoosick Swamp, south of Sebrell, no. 10,135; dry white sand in woods, Terrapin Ridge, east of Drewryville, no. 8971.

Through my own stupidity many of these numbers were hastily identified as *Cyperus filiculmis* var. *oblitus* Fern. & Griscom. The two are very different. *C. filiculmis* Vahl has scabrous-margined flat (or folded) leaves and involucres; scales of the spikelets with broad hyaline margins, the terminal scales ending in involute or subulate tips, the rachilla wingless or only narrowly winged and the style 3-cleft nearly to base. *C. Grayii,* on the other hand, has smooth, filiform or filiform-conduplicate leaves and involucres; scales narrow-margined, the midrib not at all prolonged to form slender tips, the rachilla broadly winged, and the style 3-cleft to the middle. Only through my association of *C. Grayii* with coastal sands can I explain my inexcusable misidentifications of it.

*C. ovularis (Michx.) Torr., var. sphaericus Boeckl. Elizabeth City County: Hampton, July 15, 1891, *A. B. Seymour,* no. 8.

Although Britton in Bull. Torr. Bot. Cl. xiii. 215 (1886) cited var. *sphaericus* only from Arkansas, Indian Territory (Oklahoma) and Texas, and Kükenthal adds to the range only Louisiana (type-locality) and Georgia, the variety seems to be a fairly defined one, extending northward to Virginia and into

southern Ohio (Vinton, Gallia Co., July 1901, *Kellerman*) southern Indiana (Daviess Co., *Deam*, no. 17,101) and Missouri (Sheffield, *Bush*, no. 41). The Seymour specimen is a close match for an isotype, from *Drummond's* Louisiana material. Typical *Cyperus ovularis* has the usually flat basal and involucral leaves 3–10 mm. long, the longest involucral leaf 1.2–4.5 dm. long; spikes globose-ellipsoid, definitely longer than thick, in maturity 1–2.3 cm. long and 0.8–1.8 cm. thick. Var. *sphaericus* is smaller and more slender, with firmer and more folded leaves only 1.5–5 mm. wide, the longest involucral leaf usually 0.5–1.5 dm. long; the exactly spherical heads few (1–5) and only 7–12 mm. in diameter.

*C. retrorsus Chapm. Accomac County: clearing in pine woods 3½ miles north of Accomac, no. 5231. Princess Anne County: wet depression in pine barrens, Cape Henry, *Fernald & Griscom*, no. 2791. Sussex County: sandy open woods, thickets and clearings by Nottoway River, below Peter's Bridge, southeast of Lumberton, no. 12,263. Southampton County: dry sand, pine barrens about 7 miles south of Franklin, no. 7323. Mostly distributed as var. *cylindricus* (Ell.) Fern. & Grisc.

When Griscom and I studied the variations of *Cyperus retrorsus*—see Rhodora, xxxvii. 152, 153 and plate 342 (1935)—we did not recognize typical *C. retrorsus*, with slenderly cylindric spikes bearing crowded small retrorse spikelets at base, these closely appressed to or parallel with the summit of the ray, from north of South Carolina. The typical form of the species reaches southern New Jersey.

Bulbostylis ciliatifolius (Ell.) Fernald. Range extended northward and northeastward. Sussex County: dry white sand of woods and clearings near Chub, no. 12,582. Isle of Wight County: white sand of dry pine barrens, south of Lee's Mill, no. 12,578; white sand of dry woods and clearings east of Joyner's Bridge, no. 12,267. See pp. 506 and 514.

*B. coarctatus (Ell.) Fern. Sussex County: dry white sand of woods and clearings near Chub, nos. 12,579 and 12,581; Southampton County: dry sandy woods and clearings northeast of Cypress Bridge, no. 12,580. See p. 518.

Extension north from North Carolina.

Scirpus lineatus Michx. York County: old-field swale north of Grafton, no. 11,982. See p. 504.

Collected by Grimes near Williamsburg. Very local on the Coastal Plain.

*RHYNCHOSPORA GRAYII Kunth. NORFOLK COUNTY: Norfolk, *Reed*, old specimen in Herb. Phil. Acad.

Extension north from southeastern North Carolina.

*SCLERIA FLACCIDA Steud. Syn. Pl. Cyp. 174 (1855). NORFOLK COUNTY: peaty clearing, Great Dismal Swamp, north of Yadkin, no. 12,274. First from north of South Carolina. See p. 512.

In RHODORA, xxxviii. 397, 398, pl. 444 (1936), I pointed out three species which had been confused by Core in his *American Species of Scleria*, Brittonia, ii. 63 (1936), as *S. triglomerata* Michx. These were there sufficiently discussed and illustrated by me, except that a character in the hypogynium or basal disk supporting the achene was not then emphasized. True *S. triglomerata* is a relatively coarse plant with depressed-globose achenes 2–2.5 mm. high and 2–2.7 mm. broad, nearly glabrous band on the ventral side of the leaf-sheath, and with a knotty, forking rhizome. It occurs in damp to slightly dry soils from eastern Massachusetts to southern Ohio, Wisconsin and Iowa, south to Florida, Alabama, Mississippi, Louisiana and Texas. *S. minor* (Britton) Stone is a very slender species, with achenes only 1–1.8 mm. high and 1–1.8 mm. broad, inhabiting peaty and boggy places from southern New Jersey to South Carolina. *S. nitida* Willd., with usually elongate and straightish rhizomes or branches of the rhizome, culms erect or strongly ascending and terminated by the inflorescence, without lateral branches, and membranous band of the leaf-sheath pubescent, has ovoid achenes longer than thick (2.8–3.3 mm. long, 2–2.8 mm. broad), *S. nitida* growing principally in dry sands of pinelands and barrens, from New Jersey to Georgia and southern Kentucky.

The plant (no. 12,274) found by us at the northern margin of the Great Dismal Swamp at once challenged attention: it is cespitose, making tussocks, with arching culms bearing capillary lateral branches much as in *Scleria setacea* Poir.; but its sheaths are much as in *S. nitida*, while its lustrous white to buff achenes are more slenderly ovoid. Study of the material shows a very striking difference in the hypogynium. In *S. nitida* of the pine barrens the latter is tuberculate with low rounded pebbling;

in the cespitose and more flexuous and branching plant the hypogynium has the tubercles prolonged into lance-acuminate scale-like blades. Study of all the material in the Gray Herbarium shows the Dismal Swamp plant with branching and flexuous culms and elongate achenes resting upon a hypogynium with lance-acuminate laminate tubercles to occur from Florida to Louisiana. Although the Virginia material is more slender and with narrower leaves than in the Florida plant, some of the Mississippi material and that from Louisiana is quite as slender as ours.

Since a species with so broad a range is unlikely to have been overlooked, although the plant of Florida and Mississippi, along with *S. nitida* and *S. minor*, was identified by Core with *S. triglomerata*, I have checked the original descriptions of the species thus merged by him and there seems no doubt that the cespitose plant with pubescent band on the leaf-sheath, axillary and finally prolonged and flexuous or nodding branches, slenderly ovoid achenes and laminate-tuberculate hypogynia is *S. flaccida* Steudel. Steudel clearly distinguished his new *S. flaccida* from the stiffer and unbranched *S. nitida* as follows (italics mine):

"76. S. NITIDA. *Willd.* (ex *Kunth.* l. c. [Enum. ii.] 350.) . . . achenio lapideo ovato-subgloboso umbonato laevi lacteo-candido nitido, *ad basin margine tumido trigono subtilissimo celluloso-papilloso cincto.*"

"77. S. FLACCIDA. *Steud.* Culmo tenui triquetro vix scabriusculo (2–3-pedali) flaccido, vaginis arctis simpliciter triquetris (angulis non membranaceis nec alatis); ligula brevi; spicis versus apicem caulis subcapitatis paucifloris parum remotis; spiculis androgynis masculis intermixtis; achenio ovato-suborbiculato fragili nitido lacteo laevissimo *basi margine inciso celluloso-papilloso cincto;* stipite brevissimo. A praecedente, cui quoad discum similis pluribus notis diversa. *M. Curtis* legit in Carolina austr."

As above stated, I have seen no material but ours of *Scleria flaccida* from north of Florida and the Gulf States; but since the plant is in the Great Dismal Swamp of Virginia (and, therefore, presumably in North Carolina) there seems every reason to believe that the species which Steudel had from South Carolina with "achenio . . . basi margine inciso celluloso-papilloso cincto" is our plant. As also noted, *S. flaccida* prefers wet, peaty soil, *S. nitida* dry sand, though the two are apparently not restricted to these habitats. When I showed the material

from the Great Dismal Swamp to Dr. D. S. Correll he promptly went to his Louisiana material and brought me a sheet quite like our no. 12,274, with an apology for its lack of base. It grew in an inundated gum-swamp where the muck was so deep that he could reach only the culms by creeping out on a floating log. That is *not* the habit of *S. nitida* nor of *S. triglomerata.* It may be of service to others to have the material of these two species cited. I am, therefore, listing specimens seen from south and west of Virginia.

S. NITIDA. NORTH CAROLINA: dry sterile soil, southeast of Granite Falls, Caldwell Co., *L. F. & F. R. Randolph,* no. 1063; dry woods, Columbus, Polk Co., *Peattie,* no. 1086: pineland near Lilington, Harnett Co., *Godfrey,* no. 5648; savannah at Richlands, Onslow Co., *Godfrey,* no. 4471. SOUTH CAROLINA: sand-ridge west of Paxville, Clarendon Co., *Godfrey & Tryon,* no. 1017; open white-sandy oak-pine woods east of Eutawville, Orangeburg Co., *Godfrey & Tryon,* no. 822; pine barren west of Pineville, Berkeley Co., *Godfrey & Tryon,* no. 614. GEORGIA: dry woods, summit of Chattoogata Mts., Whitfield Co., *Harper,* no. 268; dry pine woods near Belair, Richmond Co., *Harper,* no. 1316; sandy soil, Sumter Co., June 17, 1897, *Harper.* KENTUCKY: dry bank, between New Concord and Tennessee State Line, Calloway Co., *Smith & Hodgon,* no. 4096.

S. FLACCIDA. FLORIDA: oak woods and thickets, Duval Co., *Curtiss,* no. 3179; hummock, Duval Co., *Fredholm,* no. 5167; sandy oak woods by salt water, Jacksonville, *Wiegand & Manning,* no. 649; Eustis, Lake Co., *Nash,* no. 316; sand-barrens, Hillsboro River, Tampa, April 9, 1893, *Churchill:* Clearwater, *Tracy,* no. 6965; Miami, *Tracy,* no. 9288; Everglades, Dade Co., *A. A. Eaton,* no. 341a; old field, Alva, Lee Co., *Hitchcock,* no. 431. MISSISSIPPI: Biloxi, *Tracy,* no. 4805; Avondale, March 31, 1898, *Tracy.* LOUISIANA: without stated locality, *Hale;* in tupelo swamp, 3 miles northeast of Franklinton, Washington Parish, *D. S. & H. B. Correll,* no. 9200.

*CAREX LEAVENWORTHII Dewey. PRINCE GEORGE COUNTY: disturbed soil of roadside, rich wooded slopes by James River, Indian Point, no. 11,761. DINWIDDIE COUNTY: border of woods in cinders of freight-yard of Atlantic Coast Line, Petersburg, no. 11,994. SURRY COUNTY: weed in lawn, Surry Courthouse, no. 11,762. ISLE OF WIGHT COUNTY: in turf under trees by Benns Church, no. 11,995. See pp. 488 and 493.

Not cited from Virginia by Mackenzie in N. Am. Fl.

C. **virginiana** (Fernald), stat. nov. *C. crus-corvi*, var. *virginiana* Fernald in Rhodora, xxxix. 393, pl. 476, figs. 1–5 (1937).

To the several characters distinguishing the plant of bottomlands of the Meherrin and Nottoway systems in southeastern Virginia from *Carex crus-corvi* Shuttlew. of the Mississippi Basin and drainage area of the Gulf of Mexico should be added longer styles and shorter-cleft beaks of the perigynia. With so many characters and so complete isolation *C. virginiana* is better treated as a separate species, although obviously derived from the same ancestral stock as *C. crus-corvi*. On the bottomlands of the Meherrin, northeast of Gaskins, in Greensville County, the panicles reach a length of 2.1 dm. (our no. 12,953).[1]

*C. conjuncta Boott. Dinwiddie County: wooded bottomland of Appomattox River below Petersburg, nos. 11,996 and 11,997. Henrico County: bottomland woods and thickets along James River, west of Varina, no. 11,998.

First known in the Atlantic States from south of the District of Columbia. See pp. 492 and 495.

*C. decomposita Muhl. James City County: swamp along side of creek, 1 mile southwest of Williamsburg, *Grimes*, no. 3925. Isle of Wight County: cypress and gum swamp back of beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), nos. 12,597 and 12,951; similar habitat, Bailey's Beach (MacKimmie's Wharf), near Rushmere, nos. 12,598, 12,949 and 12,950. See p. 525.

The material, over-ripe and apparently not quite typical, collected in late August of 1940, seemed distinguishable from the

[1] *Carex virginiana* has been recorded only from Greensville and Southampton Counties, Virginia, where it abounds on rich bottomlands of rivers entering the sea in North Carolina. It is, therefore, significant that in the Gray Herbarium I find in the cover of *C. stipata* Muhl., var. *uberior* C. Mohr or *C. uberior* (C. Mohr) Mackenzie a very characteristic but wholly immature specimen of *C. virginiana* from river-swamp, Waccamaw River, below Longwood Landing, Horry County, South Carolina, April 22, 1932, *Weatherby & Griscom*, no. 16,441. In their report of it, as *C. stipata*, var. *uberior*, the collectors discriminatingly said: "In the last collection, kindly determined for us by Mr. Mackenzie, the leaves are deep bluish-green and the very young panicle almost as open and branched as in species of the section *Indocarex*, which superficially the specimens much resemble".—Weatherby & Griscom, Rhodora, xxxvi. 39 (1934). *Carex stipata*, var. *uberior* has yellowish-green, flaccid leaves, with the cross-puckered membranous band of the sheath friable, very thin and prolonged at summit, the spiciform panicle dense and, to quote Mackenzie, "4–10 cm. long". Weatherby & Griscom's no. 16,441 not only has the firm and heavily glaucous foliage and the firm veinless and unpuckered band of the leaf-sheath concave at summit, as in *C. virginiana*; its quite immature (not even flowering), lax panicle is more than 2 dm. long and in maturity would easily reach a length of 2.5 dm. It is most difficult to understand how it could originally have been identified by Mackenzie with his *C. uberior*.

chiefly continental *C. decomposita*, but fresh material secured in June, 1941, shows that the supposed differences do not hold. The species is primarily of the Mississippi drainage and of the Coastal Plain of the Gulf of Mexico, Mackenzie (N. Am. Fl.) citing it only from western New York, Maryland (near Great Falls of the Potomac), Ohio, Michigan, Indiana, Missouri, Arkansas, Louisiana, Alabama and Florida. Although Mackenzie did not know the species from North Carolina, it occurs in the region of Wilmington: base of cypress tree, Greenfield Lake at Wilmington, *Godfrey & Wells*, no. 4789. In the two cypress swamps of Isle of Wight County the species roots chiefly upon cypress-bases and -knees, its roots hanging down into the water.

*C. CANESCENS L., var. DISJUNCTA Fernald. PRINCESS ANNE COUNTY: swampy pools near Dam Neck, *Fernald & Griscom*, no. 4317. ISLE OF WIGHT COUNTY: cypress swamp back of sand-beach of Burwell's Bay, James River, at Bailey's Beach (MacKimmie's Wharf), near Rushmere (Fergusson's Wharf), no. 12,956. HENRICO COUNTY: sphagnous bog bordering White Oak Swamp, west of Elko Station, no. 11,991.

Extension south from Maryland. See p. 497.

*C. TENERA Dewey. HENRICO COUNTY: rich wooded slopes by James River, west of Varina, no. 11,985. SUSSEX COUNTY: bottomland woods by Nottoway River, east of Huske, no. 12,958.

Not seen by Mackenzie from Virginia. See p. 495.

C. NORMALIS Mackenzie. HENRICO COUNTY: bottomland woods and thickets along James River, west of Varina, no. 11,986. SUSSEX COUNTY: bottomland woods along Nottoway River, east of Huske, no. 12,961.

Our first stations on the Coastal Plain of Virginia. See p. 495.

*C. RENIFORMIS (Bailey) Small. SOUTHAMPTON COUNTY: small cypress swamp in sandy woods and clearings by Nottoway River, near Carey Bridge, nos. 11,989 and 12,277.

Extension north from South Carolina. See p. 494 and MAP 2.

C. JAMESII Schwein. To the single known Virginia station in Surry County add one in PRINCE GEORGE COUNTY: rich wooded slopes by James River, Indian Point, no. 11,768. See pp. 488 and 520.

*C. TETANICA Schkuhr. SUSSEX COUNTY: alluvial woods along Nottoway River at Readjuster Bridge, south of Peanut, no. 12,014.

First in Atlantic States from south of the region of Washington. See p. 501 and map 4.

C. digitalis Willd. Surry County: rich wooded ravines near James River, west of Ingersoll, no. **11,794**; steep calcareous wooded bluffs along James River, above Chippokes, no. **12,976**.

Our first stations on the Coastal Plain of Virginia where the species is largely represented by var. macropoda Fernald in Rhodora, xl. 400, t. 511, figs. 3 and 4 (1938).

*Carex digitalis Willd., var. **asymmetrica,** var. nov., perigyniis lanceolato-fusiformibus 3–4 mm. longis obsolete angulatis valde curvatis apice prolongatis.—Virginia: steep wooded banks, ravines and clearings near Three Creek, northwest of Applewhite's Church, Southampton County, May 8, 1940, *Fernald & Long,* no. 11,791 (type in Herb. Gray; isotype in Herb. Phil. Acad.), June 5, 1940, no. 12,013; about 3 miles from North Carolina line, Henry County, May 6, 1939, *J. T. Baldwin, jr.,* no. 232. Georgia: rich woods along Rocky Creek, 5 miles west of Waynesboro, Burke County, March 30, 1904, *Harper,* no. 2076. Florida: moderately damp rich woods about two miles east-southeast of Tallahassee, Leon County, at 5:35 p. m., April 26, 1925, *Harper* no. 32. See p. 489.

Typical *Carex digitalis* has the rhombic-ovoid, definitely angled and flat-faced perigynia nearly symmetrical or only slightly oblique at the short and scarcely beaked summit and mostly 2.5–3 mm. long. In var. *asymmetrica* of the South the perigynia are lance-fusiform, obscurely angled, 3–4 mm. long and tapering on one side by a long curve to the tip, thus giving a long-beaked appearance. I have sought in vain for other characters; the plants are in other respects very close to typical *C. digitalis.*

C. crebriflora Wiegand. To the first recorded Virginia station, in Southampton County, add the following. Greensville County: bottomland woods, Meherrin River, northeast of Gaskins, no. **12,962**. Southampton County: rich wooded slopes and spring-heads along Nottoway River, above Carey Bridge, no. **12,009**; sandy woods and clearings near Carey Bridge, no. **12,010**. Nansemond County: wooded bottomland of a branch near Cathole Landing, west of Factory Hill, no. **11,785**. Sussex County: alluvial bottomland woods along Nottoway River, west of Homeville, no. **12,008**. Surry County: bottomland woods along Blackwater River, about 1 mile southwest of Dendron, no. **12,963**.

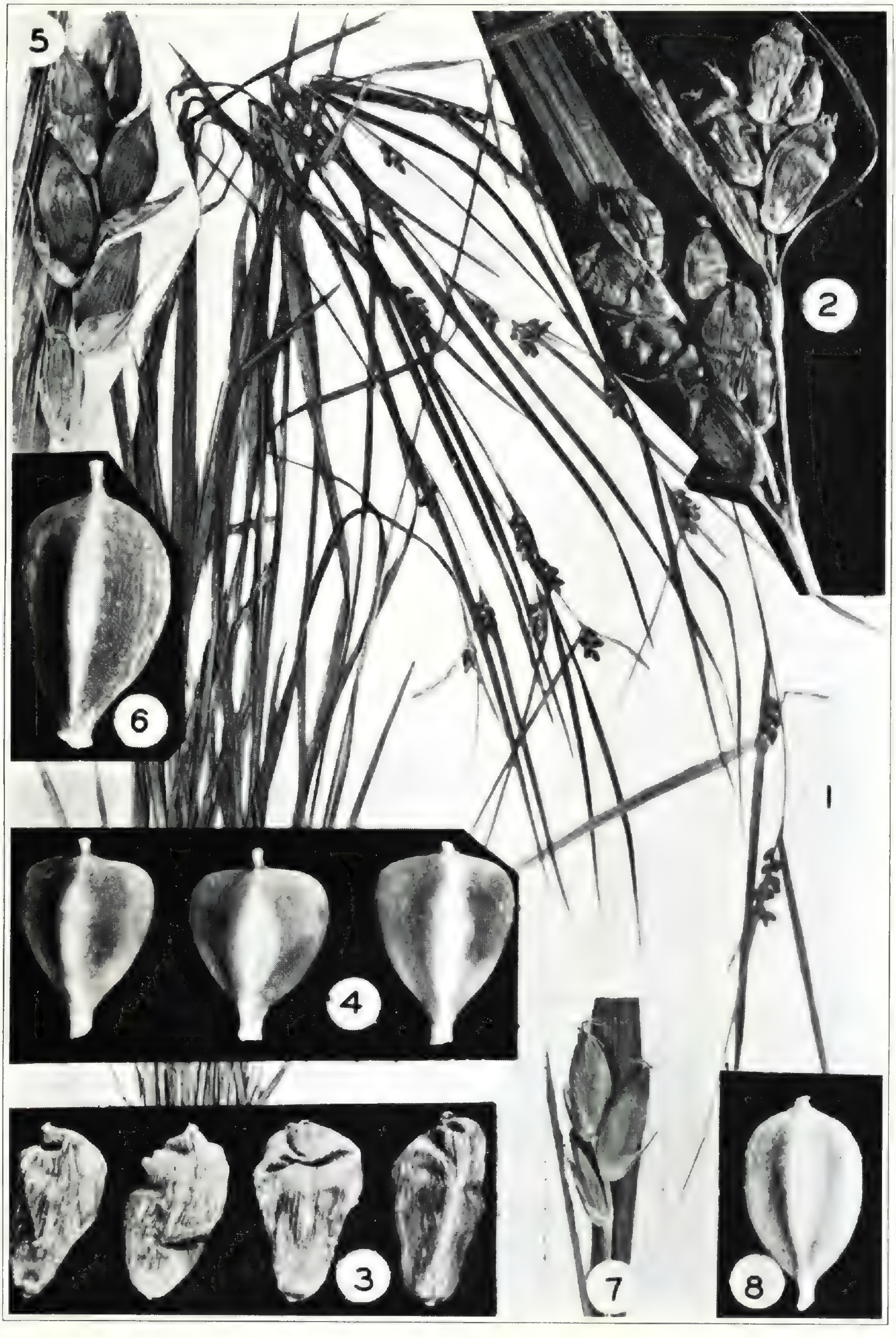


Photo. W. H. Hodge.

Carex rugata: fig. 1, habit, × ½; fig. 2, inflorescence, × 3; fig. 3, perigynia, × 5; fig. 4, achenes, × 10.
C. grisea: fig. 5, pistillate spike, × 3; fig. 6, achene, × 10.
C. amphibola: fig. 7, pistillate spike, × 3; fig. 8, achene, × 10.

C. OLIGOCARPA Schkuhr. SURRY COUNTY: low woods along Gray's Creek, near Old Courthouse Corners, no. 8624.

Our first station on the Coastal Plain of Virginia.

C. AMPHIBOLA Steud. To the original Virginia stations, recorded in 1939 for Surry and Dinwiddie Counties, add many others in these and in PRINCE GEORGE, SUSSEX, SOUTHAMPTON and GREENSVILLE COUNTIES.

*CAREX **rugata,** sp. nov. (TAB. 671, FIG. 1–4), *C. grisea* habitu simillima; foliis viridibus; perigyniis inflatis ellipsoideo-oblongis plus minusve transverse rugatis apice rotundatis vel rotundo-obliquis; achaeniis truncato-obovoideis 2–2.5 mm. longis, 1.8–2 mm. latis basi subcuneatis stipitatis.—Alluvial or bottomland woods of Nottoway River, southeastern VIRGINIA: Sussex County: west of Homeville, May 7, 1940, *Fernald & Long,* no. 11,787 (TYPE in Herb. Gray; ISOTYPE in Herb. Phil. Acad.), June 5, 1940, *Fernald & Long,* no. 12,004 (TOPOTYPE); southwest of Burt, July 25, 1936, *Fernald & Long,* no. 6110, April 3, 1938, *Fernald & Long,* no. 7783; by Nottoway River, May 20, 1939, *J. T. Baldwin, Jr.,* nos. 277, 279 and 281. Southampton County: near Courtland, June 23, 1936, *Fernald, Long & Smart,* no. 5679; above Cypress Bridge, July 23, 1936, *Fernald & Long,* no. 6109. See p. 486.

Carex rugata has troubled us in the field for five years. It is so close to *C. grisea* Wahlenb. that it would readily pass as that species, for *C. grisea* may be far from griseous in color and its perigynia (FIG. 5) are sometimes puckered. The plant along the lower Nottoway is almost ubiquitous, occupying extensive areas of wooded bottom, and every time we get into a good colony we feel that it can hardly be crowded into *C. grisea,* for the perigynia (FIGS. 2 and 3) are less definitely tipped and always with cross-wrinkling or puckering. The achenes are very different: in *C. grisea* (FIG. 6) somewhat ellipsoid-obovoid, with summit gradually rounded to the style-base, whereas the achenes (FIG. 4) of *C. rugata* are broadly cuneate-obovoid with truncate summit. The achenes of *C. grisea* are so closely invested by the perigynia that some effort and scraping are required to separate them; those of *C. rugata* are so free from the perigynia that a slight rolling of the latter promptly frees the achene. The perigynium is, obviously, readily puckered on account of this "fullness".

In outline the achene of *Carex rugata* somewhat approaches

that of *C. amphibola* Steud. (fig. 8) but the latter is more rounded at summit and the perigynia (fig. 7) are prolonged into straight subrostrate tips. Furthermore, the basal sheaths of *C. amphibola* are purple, in *C. rugata* drab.

In plate 671 figs. 1–4 are of Carex rugata Fernald: fig. 1, habit, × ½, from type; fig. 2, inflorescences, × 3, from type; fig. 3, perigynia, × 5, from topotype; fig. 4, mature achenes, × 10, from topotype. Figs. 5 and 6, C. grisea Wahlenb.: fig. 5, pistillate spike, × 3, from Middlebury, Vermont, June 22, 1878, *Brainerd;* fig. 6, mature achene, × 10, from the latter collection. Figs. 7 and 8, *C.* amphibola Steud.: fig. 7, pistillate spike, × 3, from east of Burgess Station, Dinwiddie County, Virginia, *Fernald & Long,* no. 9873; fig. 8, ripe achene, × 10, from no. 9873.

C. gracillima Schwein. To the only Virginian Coastal Plain station recorded (in Dinwiddie County) add the following. Prince George County: swampy bottomland woods along James River, Indian Point, no. 11,766. Greensville County: alluvial bottom by Three Creek, northwest of Emporia, no. 11,767.

C. prasina Wahlenb. Surry County: spring-heads, rich wooded ravines west of Claremont, no. 11,771; spring-heads and brook-sides, rich wooded ravines near James River, west of Ingersoll, no. 11,772. See pp. 488 and 521.

A northern and montane species; our first recorded from the Coastal Plain.

C. debilis Michx., var. Rudgei Bailey (*C. flexuosa* Muhl.). Sussex County: brookside in pine woods by Nottoway River, west of Lamb's no. 12,965. Southampton County: wet swampy clearing at head of rich wooded ravine, Nottoway River, near Davis School, northwest of Courtland, no. 11,764. Greensville County: alluvial bottom by Three Creek slightly above the "fall-line", northwest of Emporia, no. 11,765.

An upland plant; our first stations on and near the Coastal Plain.

*C. lanuginosa Michx. Sussex County: swales and wet thickets south of Stony Creek, nos. 11,797 and 12,024.

First in the Atlantic States from south of the District of Columbia. See p. 491.

C. Emoryi Dewey. King and Queen County: fresh tidal marsh of Mattaponi River, Walkerton, no. 12,599.

Our first station in eastern Virginia.

C. Mitchelliana M. A. Curtis. York County: margin of rill in rich wooded ravine by York River, above Yorktown, no.

12,003. Isle of Wight County: cypress swamp back of sand-beach of Burwell's Bay, James River, at Bailey's Beach (Mackimmie's Wharf), near Rushmere (Fergusson's Wharf), no. 12,978; similar habitat, below Rushmere, no. 12,979; seen in other cypress swamps along the James.

*C. lurida × squarrosa. With *C. lurida* Wahlenb. and *C. squarrosa* L. and clearly combining their characters. Sussex County: alluvial woods along Nottoway River at Readjuster Bridge, south of Peanut, no. 12,028. See p. 501.

*Arisaema triphyllum (L.) Schott, var. acuminatum (Small) Engler (*A. acuminatum* (Small). Sussex County: swampy woods northeast of Homeville, no. 12,031.

Small (Man.) restricts his *Arisaema acuminatum* to northern Florida, but says "Forms with the spathe-blade moderately long-acuminate occur in the Coastal Plain as far up as SE Va., and may represent this species". Whether they are anything but extremely large developments of *A. triphyllum* is very doubtful.

A. Dracontium (L.) Schott. To the station already reported in Southampton County add others in Sussex County: open woods along Nottoway River at Peters Bridge, no. 12,032; bottomland of Nottoway River, southeast of Stony Creek, no. 12,280.

Symplocarpus foetidus (L.) Nutt. To the very few stations on the Coastal Plain add one in Charles City County: spring-head in ravine, margin of Chickahominy River, Eagle Bottom, no. 11,656. See p. 486.

Wolffia punctata Griseb. To the few recorded stations add the following. Isle of Wight County: cypress swamp back of sand-beach of Burwell's Bay, James River, at Bailey's Beach (MacKimmie's Wharf), near Rushmere (Fergusson's Wharf), no. 12,601. King William County: pond confluent with fresh tidal marsh of Pamunkey River, Sweet Hall, no. 12,602.

Eriocaulon Parkeri Robinson. Local range extended to King and Queen County: fresh tidal marsh of Mattaponi River, Walkerton, no. 12,604.

Tradescantia virginiana L. Henrico County: embankments and cinders of Chesapeake and Ohio Railroad, west of Elko Station, no. 12,033. See p. 497.

Anderson & Woodson cite no material from the Coastal Plain.

T. canaliculata Raf. Sussex County: open woods along Nottoway River at Peters Bridge, no. 12,034. Identified by Dr. Edgar Anderson.

Anderson & Woodson cite and map no Coastal Plain station in Virginia, but many such from Florida to southeastern North Carolina. See p. 499.

Tillandsia usneoides L. Local range extended inland to northwestern Isle of Wight County: high in trees at border of cypress and gum swamp back of beach at Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,609. See p. 526.

Juncus bufonius L. To the very limited stations in southeastern Virginia add one in Princess Anne County: marshes back of the dunes, Sand Bridge, no. 12,286. See p. 512.

J. effusus L., var. costulatus Fernald. Local range extended inland. Norfolk County: wet, peaty clearings in woods of *Pinus serotina*, south of Grassfield, no. 12,037. Nansemond County: sandy and sphagnous margins of thickets in pineland southwest of Marsh Hill School, south of South Quay, no. 12,290.

J. Roemerianus Scheele. Extending up the James to Surry County: fresh to brackish tidal marshes, Hog Island, no. 12,610. See p. 522.

J. abortivus Chapm. To the two areas already recorded add another in Isle of Wight County: very abundant in moist sandy and peaty pine barrens, south of Lee's Mill, no. 12,611. See p. 519.

J. diffusissimus Buckl. Local range extended into Greensville County: argillaceous clearing in swampy woods near Readjuster Bridge over Nottoway River, northeast of Orion, no. 12,039. See p. 500.

Tofieldia racemosa (Walt.) BSP. To the stations in adjacent counties add one in Isle of Wight County: moist sandy and peaty pine barrens, south of Lee's Mill, no. 12,294.

Amianthium Muscaetoxicum (Walt.) Gray. Local range extended into Isle of Wight County; swampy depressions in sandy pine barrens and open woods, south of Lee's Mill, no. 12,041. See p. 502.

Stenanthium gramineum (Ker.) Kunth. Sussex County: open woods along Nottoway River at Peters Bridge, nos. 12,043 and 12,295.

Far remote from its stations in Shenandoah and Highland Counties, recorded in Claytonia, i. no. 2: 13 (1934). See p. 499.

*Allium Ampeloprasum L., var. atroviolaceum (Boiss.) Regel. York County: becoming very abundant, open roadside and fields south of Yorktown, no. 12,046; abundant near mouth of Indian Fields Creek, above Yorktown, no. 12,047.

Very handsome on account of its large globular dark purple inflorescences but likely to become a worse pest than *A. vineale*, the deep-seated bulbs bearing very numerous small bulblets which rapidly spread the plant. See p. 504.

A. canadense L. Henrico County: sphagnous bog bordering White Oak Swamp, west of Elko Station, no. 12,044. Sussex County: alluvial woods along Nottoway River at Readjuster Bridge, south of Peanut, no. 12,045. Greensville County: similar situation to last, north of Orion, no. 12,212.

Our first stations on the Coastal Plain of Virginia.

Erythronium americanum Ker.

In a piece of rich woodland northwest of Emporia where in favorable conditions the flowers, borne 3 dm. above the bulb, had perianths 3.3 cm. long, individuals growing in thin sterile soil were only 1–1.5 dm. high and with perianths down to 1.8 cm. long. This variation was clearly due to increase or decrease of nutrition.

Smilax hispida Muhl. To the few recorded stations on the Coastal Plain add the following. Prince George County: thickets at upper border of beach of James River, Windmill Point, Flowerdew Hundred, no. 12,990. Sussex County: rich woods by Nottoway River, southeast of Stony Creek, no. 12,229; alluvial woods along Nottoway River at Readjuster Bridge, south of Peanut, no. 12,300. York County: rich wooded ravine by York River, above Yorktown, no. 12,048. See pp. 510 and 524.

Discorea Batatas Dcne. Henrico County: abundantly naturalized in border of rich woods near margin of a canal from James River, Richmond, no. 12,304. See p. 510.

Iris Pseudacorus L. York County: swale by a small branch near York River, above Yorktown, no. 12,051.

Cleistes divaricata (L.) Ames. To the small and scattered stations in adjoining counties add an equally meagre one in Isle of Wight County: moist sandy and peaty pine barrens south of Lee's Mill, no. 12,616. See p. 519.

Triphora trianthophora (Sw.) Rydb. Surry County: rich calcareous wooded ravine west of Claremont, no. 12,617.

Our first station on the Coastal Plain of Virginia. See p. 520.

Calopogon pallidus Chapm. Range extended north into Isle of Wight County: moist sandy and peaty pine barrens south of Lee's Mill, very scarce, no. 12,310. See pp. 502 and 508.

*C. pulchellus (Sw.) R. Br., forma albiflorus (Britton) Fernald. Nansemond County: sandy and peaty pine barrens northeast and east of Cox Landing, south of South Quay, no. 12,059; sphagnous savannah-like swale east of Cherry Grove, south of South Quay, no. 12,060, very abundant.

Ordinarily the albino form is rare and casual, but at the station of no. 12,060 it abounds, many scores of plants with their milk-white flowers making a striking display. See p. 502.

Malaxis floridana (Chapm.) Kuntze. To the few recorded stations add the following. Surry County: rich calcareous wooded ravine west of Claremont, plants scattered, rather scarce, no. 17,618. Isle of Wight County: border of cypress and gum swamp back of the beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), very scarce, no. 12,619. See pp. 520 and 525.

Hexalectris spicata (Walt.) Barnh. To the now several known stations add one of 20 or more plants in Sussex County. See pp. 507 and 518.

*Corylus americana Walt., var. missouriensis A. DC. Sussex County: rich woods along Nottoway River, east of Huske, nos. 12,330 and 12,331; rich woods by Nottoway River, above Readjuster Bridge, south of Peanut, no. 12,997. See p. 509.

*× Quercus caduca Trelease (*Q. cinerea* × *nigra*). Nansemond County: a small tree in white sand of pine and oak woods and clearings near Cathole Landing, west of Factory Hill, no. 12,326. See p. 509.

*× Q. carolinensis Trelease (*Q. cinerea* × *marylandica*). Isle of Wight County: tree 25 feet high, in dry sandy pine barrens, south of Lee's Mill, no. 12,627. See p. 508.

*× Q. ludoviciana Sargent (*Q. falcata* × *Phellos*). Princess Anne County: large tree in clearing near landing, Ragged Island, no. 12,323. See p. 513.

*Q. virginiana Mill., forma macrophylla (Sargent) Trelease. Princess Anne County: abundant in low woods along Back Bay, Cedar Island, no. 12,325.

Trees with large leaves (1 dm. long, 4 cm. broad) as abundant as typical small-leaved *Q. virginiana*. See p. 513.

Ulmus fulva Michx. Extending down the James to Isle of Wight County: (several nos.).

Aristolochia Serpentaria L., var. hastata (Nutt.) Duchartre (*A. hastata* Nutt.). Dinwiddie County: rich deciduous woods about old marl-pits east of Burgess Station, nos. 9914 and 10,248 (passing into typical *A. Serpentaria*). Southampton County: rich wooded slopes and spring-heads along Nottoway River, above Carey Bridge, no. 12,064; rich wooded ravines, slopes and clearings along Nottoway River, near Davis School, northwest of Courtland, no. 11,817.

In Gray's Man., ed. 7, and in Britton & Brown's Illustrated Flora, ed. 2, only tentatively included as extending north into Virginia.

*RUMEX ALTISSIMUS Wood. DINWIDDIE COUNTY: waste ground and cinders of freight-yard of Atlantic Coast Line, Petersburg, no. 12,065.

No specimens in Gray Herbarium from south of Maryland; cited in Trelease's Monograph as south only to the District of Columbia. See p. 493.

CHENOPODIUM LEPTOPHYLLUM Nutt. To the station near Cape Henry add one (adventive) in SOUTHAMPTON COUNTY: by railroad, Courtland, no. 12,069.

C. BOSCIANUM Moq. ISLE OF WIGHT COUNTY: sandy beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,645. SUSSEX COUNTY: disturbed spot at border of dry sandy hickory and oak woods near Chub, no. 12,644.

Our first specimens on the Coastal Plain. See p. 519.

SALSOLA KALI L. Extending up the James to ISLE OF WIGHT COUNTY: sandy beach of Burwell's Bay, below Rushmere (Fergusson's Wharf), no. 12,647.

PARONYCHIA RIPARIA Chapm. Range extended northeastward into ISLE OF WIGHT COUNTY: white sand of dry woods and clearings east of Joyner's Bridge, no. 12,344.

CERASTIUM BRACHYPETALUM Desportes. To the first American station (south of Franklin), recorded in 1939, add another, also in SOUTHAMPTON COUNTY: roadside thicket, bordering dry sandy pine woods by Nottoway River, near Carey Bridge, no. 11,821.

*SILENE CUCUBALUS Wibel. YORK COUNTY: sandy beach of York River and fields above Yorktown, no. 12,073. HENRICO COUNTY: cinders of Chesapeake and Ohio Railroad, Elko Station, no. 12,072. See p. 505.

Extension south from Maryland and the District of Columbia.

*S. ANTIRRHINA L., forma DEANEANA Fernald. YORK COUNTY: open roadside banks south of Yorktown, no. 12,071.

*CERATOPHYLLUM ECHINATUM Gray. SUSSEX COUNTY: in water at margin of Chappell's Millpond (Honey Pond), west of Lumberton, no. 12,346. PRINCESS ANNE COUNTY: West Branch Creek, west of Pungo, no. 10,642. See p. 508.

The study by Dr. W. C. Muenscher in Am. Journ. Bot. xxvii. 231–233 (1940) brings out the apparently constant relation of the fruit-characters to the foliage of seedlings in *C. echinatum* and the commoner and amphigean *C. demersum.* Study of all fruiting material in the Gray Herbarium shows that, in addition to the fruit-characters (which are seen in only 1 collection in 10 or 20), the two can be separated by mature foliage. In

C. demersum the leaves have the capillary to linear and flattened divisions serrate; in *C. echinatum* they are all subcapillary (not linear) and entire. In the collections before me *C. demersum* exhibits a semicosmopolitan range, in North America found from Quebec to British Columbia and far to the south. *C. echinatum* seems to be strictly North American, from Florida to Texas and Mexico, north to southern Maine, southwestern Quebec, New York, Ohio, Michigan and Illinois. The collections assembled in the herbarium show 2 or 3 sheets of *C. demersum* to every 1 of *C. echinatum* over the same broad area.

Ranunculus carolinianus DC. A new northern outpost in Prince George County: swampy bottomland woods along James River, Jordan Point, no. 11,831. See p. 488.

*Hepatica americana (DC.) Ker., forma rhodantha Fernald. Southampton County: rich marly woods along Three Creek, northwest of Carey Bridge, no. 11,678.

*H. americana, forma candida Fernald. Surry County: rich wooded ravine northwest of Ingersoll, no. 11,680.

Caltha palustris L. To the very scattered Coastal Plain stations add one in Surry County: along brook at base of rich wooded ravine northwest of Ingersoll, no. 11,681. See p. 486.

Xanthorhiza simplicissima Marsh. Henrico County: rich wooded slopes by James River, west of Varina, no. 12,080. Southampton County: rich woods and thickets near Raccoon Creek, north of Mill Neck Church, no. 12,350. Nansemond County: dry wooded slope by a branch entering Blackwater River, northwest of Duck's Store, no. 12,351.

Our first Coastal Plain stations. See pp. 495 and 508.

Asimina parviflora (Michx.) Dunal. Local range extended into Isle of Wight County: white sand of dry pine barrens, south of Lee's Mill, no. 12,657. See pp. 492 and 519.

Corydalis flavula (Raf.) DC. Henrico County: rich wooded slope of ravine by James River, west of Varina, no. 11,686; railroad bank bordering White Oak Swamp, west of Elko Station, no. 11,687. Prince George County: rich wooded slopes by James River, Indian Point, nos. 11,685 and 11,838. Dinwiddie County: wooded bottomland of Appomattox River below Petersburg, no. 12,083.

Our first Coastal Plain stations; but previously reported from Virginia Beach. See pp. 486 and 488.

Draba brachycarpa Nutt. Sussex County: dry white sand of woods and clearings near Chub, no. 12,658. Southampton County: weed in lawn of courthouse, Courtland, no. 11,839.

Our first Coastal Plain stations. See p. 489.

ARABIS LAEVIGATA (Muhl.) Poir. Local range extended eastward into YORK COUNTY: rich wooded ravine by York River, above Yorktown, no. 12,086. See p. 505.

A. CANADENSIS L. Now added to the remarkable assemblage of inland and upland types in SURRY COUNTY: dry wooded upper slopes of ravines west of Claremont, no. 12,660. See p. 521.

SEDUM TERNATUM Michx. To the relatively few known stations on the Coastal Plain add one in SUSSEX COUNTY: on a steep slope, woods by Nottoway River, southwest of Lamb's, no. 12.357.

(*To be continued*)

NOTES FROM THE UNIVERSITY OF MINNESOTA HERBARIUM II[1]

JOHN B. MOYLE[2]

EXTENSIONS OF RANGES AND ADDITIONS TO THE MINNESOTA FLORA

TYPHA ANGUSTIFOLIA L. Of scattered occurrence in the harder-water areas, especially in the southwestern part of the State. Most of the following collections represent isolated patches occurring in stands of *T. latifolia* L. Although *T. angustifolia* was reported for Minnesota by *Upham* in 1887[3] and *Holzinger* in 1896,[4] no collections have been available until recently. HUBBARD CO.: stream channel, Shallow L., *Moyle* 3425. KANDIYOHI CO.: shores of L. Calhoun, *Moyle* 3192. MARTIN CO.: School Section L. near Fairmont, *Moyle* 3425. MURRY CO.: Valhalla Bay, L. Shetek, *Moyle* 3143. RAMSEY CO.: Birch L., *W. J. Breckenridge* Oct. 23, 1937.

SCIRPUS HETEROCHAETUS Chase. Occasional throughout the State but most abundant southwestward in prairie lakes and pools. In Minnesota this species seldom occurs in pure stands but is usually associated with *S. acutus* Muhl. or *S. validus* Vahl. AITKIN CO.: Big Sandy L., *P. K. Nurnberger* P2851; Backwater L., *Hotchkiss & Jones* 4100. BROWN CO.: L. Hanska, *Hotchkiss & Jones* 3949. CHIPPEWA CO.: common in Drywood L., *Moyle* 3212. FREEBORN CO.: prairie swale, *Moyle* 2902.

[1] Specimens cited are all in the Univ. of Minn. Herbarium. All specimens of a given species or variety are cited. The counties mentioned are all in Minnesota.

[2] Aquatic Biologist, Minn. Dept. Conserv., Div. of Game and Fish, St. Paul.

[3] Upham, Cat. of the Flora of Minn.; Geol. and Nat. Hist. Surv. of Minn. Part VI of Ann. Rep. for 1883.

[4] Holzinger, Minn. Bot. Stud. 1: 519; 1896.

Lac qui Parle Co.: muddy swamp near Lac qui Parle, *Moyle* 3193. Lake of the Woods Co.: Lake of the Woods, *MacMillan & Sheldon* 596. Pope Co.: small pool N. E. ¼ Langhei Twp., *Hotchkiss & Jones* 4005.

Scirpus subterminalis Torr. Fairly common in soft-water lakes and streams of northeastern Minnesota, but until recently represented by one collection. Clearwater Co.: Squaw L. in 4 feet of water, *M. L. Grant* 6472. Cook Co.: Temperance R., abundant on sand and rock in 3 feet of water, *C. B. Reif* A21; Brule R., common in 2 feet of water on rock, *C. B. Reif* A28. Lake Co.: Baptism R., common in ponded water of East Branch, *Moyle* 3448; Spring L., on mud in 1 to 3 feet of water, *W. G. Moore*. St. Louis Co.: lake at the head of Dark Horse Cr., *Moyle* 2537. Stearns Co.: St. Cloud, *J. Campbell* 82.

Polygonum coccineum Muhl. var. rigidulum (Sheldon) Stanf. Aitkin Co.: Big Sandy L., in 3 feet of water on sand, *Moyle* 3156; Big Sandy L., *P. K. Nurnberger* 2852, 2837. Cass & Itasca Co.: Winnibigoshish L., in 3 feet of water on sandy muck, *L. L. Smith* 481, 482. Chippewa Co.: Mud Lake, common in newly flooded areas in 3 feet of water on mud, *Moyle* 3527; Chippewa R., *G. & L.* June 28, 1885. Chisago Co.: Cut Foot Sioux L., rare in 1 foot of water on sand, *L. L. Smith* 10, 11, 12. Kanabec Co.: Mora, *Sheldon* 3151. Nicollet Co.: Nicollet, *C. A. Ballard* 1018. St. Louis Co.: L. Kabetogama, in 4 to 5 feet of water in heavy waves, *Moyle* 2615.

In Minnesota this variety is usually found in flowage areas or in lakes subject to considerable fluctuation in water level or heavy wave action. The floating stem with its inflated and upward tapering internodes allows it to flower in water as deep as five feet. Field observations suggest that it is probably an extreme ecological development of forma *natans* (Wiegand) Stanf. which replaces var. *rigidulum* in shallow pools and along sheltered lake margins. The diagnostic differences noted in the shape of the leaf blades by Stanford[1] do not hold for the Minnesota material. The lower leaves of both aquatic forms are usually cordate or truncate at the base. The only consistent difference is the presence of the inflated internodes in var. *rigidulum*. The type specimen of *P. rigidulum* Sheldon, *Sheldon* 3151, has seven leaves, two of which have cordate, two truncate and three rounded or tapering bases.

Stellaria aquatica (L.) Scop. Previously reported from the vicinity of Duluth[2] and recently collected from several stations

[1] Stanford, Rhodora **27**, 156; 1925.

[2] Lakela, Rhodora **40**, 280; 1938.

in central Minnesota. MILLE LACS CO.: bank of Rum R. at Milaca, growing partly submerged on sand and muck, *Moyle* 3311, 3314; Robinson Brook, growing on edge of stream and in shallow water, *Moyle* 3313; along West Branch of Rum R. near Foreston, *Moyle* 3320.

SILENE CSEREI Baumg. This Eurasian adventive, which has been previously reported from COOK CO.,[1] has been recently taken at three additional stations. BENTON CO.: bank of Mississippi R. at Sartell, *Moyle* 3337. HUBBARD CO.: roadside near Kabekona R., *Moyle* 2151; roadside between Itasca Park and Park Rapids, *Moyle* 1435.

SPERGULARIA RUBRA (L.) J. & C. Presl. A single collection from CLEARWATER CO.: weed in sandy soil, nursery near Alida, *Moyle* 2736.

RANUNCULUS TRICHOPHYLLUS var. ERADICATUS (Laestadius) Drew. Occasional in the soft waters of the Archaean rock region north of L. Superior. COOK CO.: Temperance R., scarce on sand and rocks in 1 foot of water, *C. B. Reif* 2; Mark Cr., abundant on muck in 1 foot of water, *C. B. Reif* 24; Brule R., *C. B. Reif* Aug. 1938. LAKE CO.: Surprise L., *U. S. For. Serv.* Sept. 17, 1935; Heart L., *U. S. For. Serv.* Aug. 21, 1935.

AMMANNIA COCCINEA Rottb. Previously known from one collection in TRAVERSE CO.: Browns Valley, *Sheldon* 7014. Recently found in CHIPPEWA CO.: occasional on silty shore of Watson Sag, Lac qui Parle, *Moyle* 3506.

MYRIOPHYLLUM ALTERNIFLORUM DC. Not previously reported, but fairly common in soft-water lakes and streams of the northeastern part of the State. COOK CO.: Temperance R., on sand and rock in 2 and 3 feet of water, *C. B. Reif* A16, A4; Bearskin L., *U. S. For. Serv.* Aug. 28, 1935. LAKE CO.: Spring L., on mud in 10 inches of water, *W. G. Moore* V508; East Branch Baptism R., ponded water on muck, *Moyle* 3540; Grass L. (T. 60 R. 9W), *U. S. For. Serv.* Aug. 9, 1935; Lena L., *U. S. For. Serv.* Aug. 6, 1935. ST. LOUIS CO.: Bates L., *M. Morse* 1937.

MYRIOPHYLLUM FARWELLII Morong. Not previously reported. LAKE CO.: Nine Mile Cr., Manitou R. system, in 1 foot of slow water, *Moyle* 3435a; a terrestrial form was taken on mud banks at the preceding location, *Moyle* 3435b. ST. LOUIS CO.: common in channel between King and Coyote Lakes, on mud in 1 foot of water, *Moyle* 3513.

MYRIOPHYLLUM TENELLUM Bigel. Known from two stations. PINE CO.: Sturgeon L., *W. S. Cooper* Aug. 22, 1930. ST. LOUIS CO.: Auto Club L. near Virginia, *Arthur Horn* July 14, 1936.

MYOSOTIS LAXA Lehm. Only recently collected in Minnesota. CROW-WING CO.; bank of Crow-Wing R. near Pillager, *Moyle* 3343. WADENA CO.: moist bank of Leaf R., *Moyle* 3338.

[1] Fassett, RHODORA **36**, 352; 1934.

Solanum carolinense L. Not previously reported. Wright Co.: in large patches on the bank of the Crow R. near Rockford, *Moyle* 3391.

Linaria genistaefolia (L.) Mill. Pope Co.: well established along road near Glenwood, *Moyle* 3140.

Minnesota Department of Conservation, St. Paul

Salvinia rotundifolia in Massachusetts.—On August 13 of this year Miss Margery Coffin brought a small aquatic to the Gray Herbarium for identification in connection with her work of disguising water-surfaces for the Camouflage Project. This proves to be the tropical *Salvinia rotundifolia* Willd. with its characteristic large free-branched trichomes. In his monograph of the genus in Hedwigia, Herzog cites no material north of Mexico, although there are specimens from the southern United States in the Gray Herbarium. Miss Coffin says that the species is well established on a pond in Foxboro, Massachusetts, where it doubtless started from material thrown out of an aquarium. —L. B. Smith, Gray Herbarium.

The Spelling "pensylvanica" again.—In view of the recent discussions of the correct spelling of the specific name, it is worth recording that Dr. George Neville Jones sends in a clipping from a paper with a photograph of the "Liberty Bell" bearing in an English context the name of the state, PENSYLVANIA, and the comment "If the inscription on the Liberty Bell is taken as an authority, then all of us are spelling Pennsylvania wrong!"—Eds.

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Vol. 43. November, 1941. No. 515.

NOTE ON THE NAME EUPATORIUM RUGOSUM

S. F. Blake

It has recently been shown by Dr. E. D. Merrill[1] that *Eupatorium rugosum* Houtt. (1779) is the valid name for the common white snakeroot, long known as *Eupatorium ageratoides* L. f. (1781) and later as *E. urticaefolium* Reichard (1780). The plant is of economic importance as the cause of the often fatal disease of cattle known as "trembles." The poisonous properties transmitted in milk cause the disease known as "milk sickness," which in the early days of settlement of the Middle West sometimes reached epidemic proportions and depopulated whole villages.[2] Several varieties based on varying degrees of pubescence (the typical form being essentially glabrous) and on leaf shape have been distinguished. New combinations for them are published here in order that the names may be available for use.

Eupatorium rugosum Houtt. var. **angustatum** (Gray), n. comb.—*E. ageratoides* var. *angustatum* Gray, Syn. Fl. **1**²**:** 101. 1884. *E. angustatum* Greene, Pittonia **4:** 277. 1901. *Kyrstenia angustata* Greene, Leafl. **1:** 8. 1903. *E. urticaefolium* var. *angustatum* Robinson, Proc. Amer. Acad. **51:** 537. 1916.

E. rugosum var. **tomentellum** (Robinson), n. comb.—*E. urticaefolium* var. *tomentellum* Robinson, Proc. Amer. Acad. **47:** 195. 1911.

[1] Rhodora **40**: 293. 1938.

[2] See James F. Couch, The toxic constituent of richweed or white snakeroot (Eupatorium urticaefolium), Journ. Agric. Res. **35**: 547–576. 1927, for a review of the history of the disease with references to the important literature.

Originally described from Wisconsin, Illinois, and Michigan; I collected specimens (no. 11080) so identified by Dr. Robinson on tidal shore of Delaware River at Beverly, Burlington Co., New Jersey, on 9 Oct. 1929.

E. RUGOSUM var. **villicaule** (Fernald), n. comb.—*E. urticaefolium* var. *villicaule* Fernald, RHODORA **10:** 87. 1908.

Besides these variants, which show differences that appear to be of some real significance, a form with leaves in threes instead of in pairs has been described from Michigan as *E. urticaefolium* var. *trifolium* Farwell (Rep. Mich. Acad. Sci. **17:** 170. 1916), and independently from Quebec as *E. urticaefolium* f. *verticillatum* Marie-Victorin (Trans. Roy. Soc. Canada III. **20** (Sect. 5): 471. 1926). It does not seem that any useful purpose is served by assigning botanical names to the frequent specimens of normally opposite-leaved Compositae that are found with ternate leaves.

The varietal and formal names that have been published under *E. urticifolium* (*sic*) for Paraguayan members of the genus relate not to the North American *E. urticaefolium* Reichard (1780) (= *E. rugosum* Houtt.) but to *E. urticaefolium* L. f. (1781), a South American species. According to Robinson, the name *Eupatorium urticaefolium* L. f. itself, as to type, is to be referred[1] to the synonymy of *E. ballotaefolium* H. B. K., while the species called *E. urticaefolium* L. f. (or *E. urticifolium*) by Baker and other writers on South American botany is properly known[2] as *E. pauciflorum* H. B. K.

As Dr. Merrill has pointed out, the adoption of the name *Eupatorium rugosum* Houtt. for the plant of eastern North America leaves the Ecuadorian *E. rugosum* H. B. K. (Nov. Gen. & Sp. **4:** 114. 1820) without a tenable name. It may be renamed EUPATORIUM **bulliferum**. According to Robinson's revision of the Eupatoriums of Ecuador, it is still known only from the original collection made by Humboldt and Bonpland.

DIVISION OF PLANT EXPLORATION AND INTRODUCTION,
BUREAU OF PLANT INDUSTRY,
Washington, D. C.

[1] Proc. Amer. Acad. **54:** 321. 1918.
[2] Proc. Amer. Acad. **42:** 46. 1906 and **54:** 319. 1918.

Photo. W. H. Hodge.

Amelanchier canadensis: fig. 1, type, from Linnean Herbarium, × 1.
A. arborea: fig. 2, portion of original plate of F. A. Michaux.
A. obovalis: fig. 3, flowering branch, showing the short racemes; fig. 4, fruiting branch; both × 1

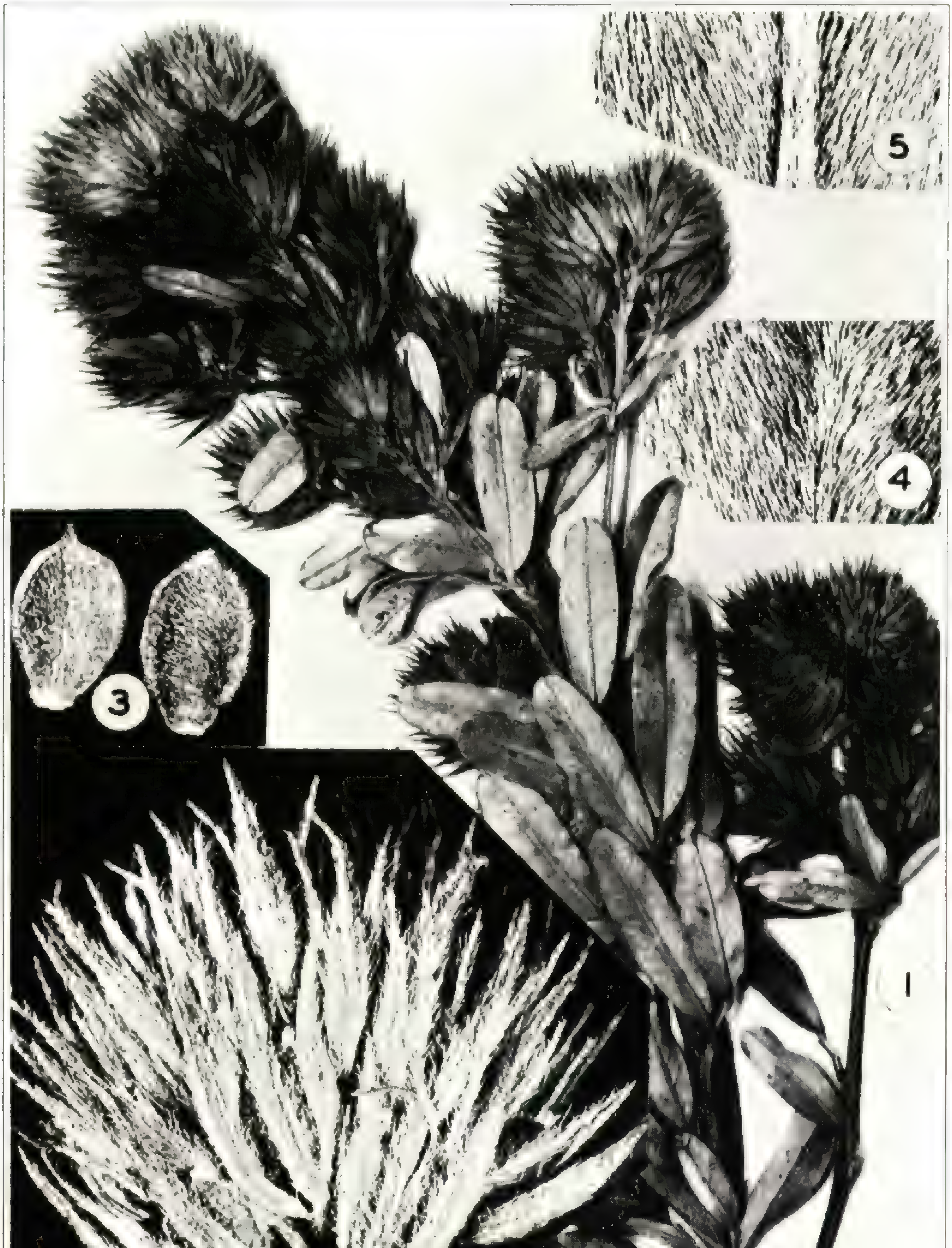

Photo. W. H. Hodge.

Lespedeza capitata, var. typica: fig. 1, summit of fruiting stem, × 1; fig. 2, fruiting head, × 4; fig. 3, legumes, × 4, from base of fruiting calyx; figs. 4 and 5, upper and lower surfaces of leaf, × 10.

ANOTHER CENTURY OF ADDITIONS TO THE FLORA OF VIRGINIA

M. L. Fernald

(*Continued from page 553*)

Hydrangea arborescens L. In southeastern Virginia two strikingly different extremes of the species occur: typical *H. arborescens,* with the principal leaf-blades broadly ovate to suborbicular, cordate to broadly rounded at base, the better developed ones two-thirds as broad to as broad as long (8–15 cm. broad); and var. oblonga Torr. & Gray, with the principal leaf-blades gradually rounded to tapering at base, narrowly ovate to lance-elliptic or -oblong, the better developed ones one-third to two-thirds as broad as long (3–8 cm. broad). The original Clayton material was of the first variety. The specimens before me (besides a tracing of the Clayton type) show typical *H. arborescens* in southeastern Virginia only from the calcareous area of the James River bluffs and ravines; var. *oblonga* more widely dispersed.

H. arborescens L. (typical). Surry County: rich wooded gullies along James River, below Sunken Meadow Beach, nos. 8285 and 13,034. Isle of Wight County: seeping argillaceous and calcareous bluffs along Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), nos. 12,662 and 13,032; similar habitat, west of Fort Boykin, no. 13,033. Forma grandiflora Rehder, with all the flowers sterile and showy, is cultivated; collected on rubbish near Emporia, no. 6601. See p. 523.

H. arborescens L., var. oblonga Torr. and Gray. Surry County: rich woods on fossiliferous sandy slopes of gullies near Claremont Wharf, no. 7863; rich calcareous woods at head of Sunken Meadow Creek, south of Claremont, no. 8284. Isle of Wight County: seeping calcareous bluffs along Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 13,035; similar habitat, west of Fort Boykin, no. 13,036. York County: rich wooded ravine by York River, above Yorktown, nos. 12,093 and 12,094. Southampton County: rich wooded ravine by Nottoway River, near Davis School, northwest of Courtland, no. 11,697. Middlesex County: wooded slope by Rappahannock River, Bay Port, no. 13,348.

Amelanchier in Southeastern Virginia (plate 672).—In late March and early April *Amelanchier* is fully flowering in

southeastern Virginia; and the rather scanty or too often blasted fruits are mature in May or June. Three species are tall fastigiate shrubs from 1.5–5 m. high, one of these often becoming a fine tree up to 10 (or even 13) m. high; the fourth species is a low colonial shrub, spreading by stolons and forming loose colonies with flowering or fruiting stems only 0.2–1 m. high, suggesting but quite distinct from the northern *A. stolonifera* Wiegand. All four are readily matched with types or isotypes of species already described, but in at least two cases the types of Linnaeus and of Michaux have been so misinterpreted by recent students of the genus that it is necessary to start at the beginning!

Mespilus canadensis L. Sp. Pl. i. 478 (1753) was published with unusual lack of involving references, merely the plant of Linnaeus's herbarium described, with a single reference to a description of Gronovius. The original treatment follows:

canadensis. 5. MESPILUS inermis, foliis ovato-oblongis glabris serratis, caule inermi.
Mespilus inermis, foliis subtus glabris obverse-ovatis. *Gron. virg.* 54.
Habitat in Virginia, Canada. ♄

The late Dr. B. Daydon Jackson has indicated that Linnaeus had material of this species in his herbarium during the preparation of the first edition of Species Plantarum. That, therefore, is the type material; and Mr. Savage sent me some years ago photographs of these 3 sheets of *M. canadensis* which Linnaeus had prior to 1753: two sheets not marked by Linnaeus but conspecific with sheet no. 19, clearly marked by Linnaeus "5 K *canadensis*", i. e. species no. 5, collected by Kalm. This, the TYPE (because bearing the specific name in Linnaeus's hand and, as shown in the photograph, "foliis ovato-oblongis"), is here reproduced as PLATE 672, FIG. 1. That it is very characteristic *Amelanchier oblongifolia* (T. & G.) Roemer, based on *A. canadensis*, var. *oblongifolia* T. & G., can hardly be doubted, a conclusion independently reached by Mr. C. A. Weatherby when he looked up the material in the Linnean Herbarium. It is, therefore, unfortunate that, when he so clearly differentiated our species of *Amelanchier* and thus gave study of the genus a new

and stimulating interest, Wiegand[1] seems to have misunderstood the basis of *A. canadensis.* He had had a comparison made by a botanist not familiar with the eastern species and he then used the Linnean name for the largest member of the genus, the large shrub or tree with cordate, ovate or broadly ovate-oblong, sharply serrate leaves which, like those of true *A. canadensis* (*A. oblongifolia*), are pubescent beneath on unfolding, losing most of their pubescence with age. The latter tree has often been called *A. Botryapium* (L. f.) Borkh.; but this combination rests directly on *Pyrus Botryapium* L. f. Suppl. 255 (1781), which was based upon the *Mespilus canadensis* of Murray's ed. 13 of L. Syst. Veg. (1774). Murray altered the original Linnean account and omitted the Gronovian citation and, as in case of the other species, also the geographic source. Murray's alteration resulted in the following, under *Mespilus:*

> *canadensis.* 5 M. inermis, fol. ovato-oblongis glabris serratis acutiusculis. *Tenera lanata; adultior nuda. Racemi elongati.*

The diagnosis of Linnaeus filius of his *Pyrus Botryapium* was compounded from the description by his father and that of Murray of *Mespilus canadensis:*

> *Botryapium.* PYRUS inermis, foliis ovato-oblongis serratis acutis, racemis simplicibus elongatis.
> Mespilus canadensis. *Syst. veg. ed.* 13. *p.* 388.
> *Habitat* in Virginia, Canada. *Ehrhart.* ♄

Mr. Savage sent me photographs of all the specimens in the Linnean Herbarium which were placed by Linnaeus and his later editors under *Mespilus canadensis.* These all belong to *M. canadensis* as above typified. I can see, therefore, no probability that, when Murray redescribed *M. canadensis*, he was defining a different species nor that the younger Linnaeus, under the name *Pyrus Botryapium*, was defining a species different from that originally diagnosed by his father. Neither Murray nor Linnaeus filius otherwise disposed of the original *Mespilus canadensis* of 1753. The fact that in the Supplement the latter did not cite *M. canadensis* as starting with Species

[1] Wiegand, *The Genus Amelanchier in eastern North America,* Rhodora, xiv. 117–161, plates 95 and 96 (1912).

Plantarum (1753) is of no significance, for it was his regular practice to cite the species there as starting not from Sp. Pl. but from the latest treatments: *Mespilus Amelanchier* from Syst. Veg. ed. 13, not Sp. Pl. ed. 1; *M. arbutifolia* from Syst. Nat. ed. 13, not Sp. Pl. ed. 1; etc., etc. The younger Linnaeus gave in addition to the brief diagnosis a somewhat detailed description of *Pyrus Botryapium,* but this is wholly consistent with sheet no. 21 in the Linnean Herbarium, also Kalm material, this in flower, of true *Mespilus canadensis:* a branch with unfolding white-felted leaves, racemes with lanate hypanthium, ascending calyx-lobes and relatively short petals (perfectly characteristic *Amelanchier oblongifolia*).

Under "*A. canadensis*" of his treatment Wiegand cites numerous synonyms besides *Pyrus Botryapium* and its resultant combinations. The first two are cited with doubt, and this doubt must still continue. The first is *Crataegus racemosus* Lam. Encyc. i. 84 (1783). Lamarck's account was very sketchy and he thought that the shrub cultivated in the Jardin du Roi might be *Mespilus canadensis.* It was a branching shrub 6–10 feet high, with oval-oblong, acute, dentate leaves white-felted beneath when unfolding but becoming glabrate. This account is too like that of *Mespilus canadensis,* then cultivated in European gardens; furthermore, Professor Humbert and M. Metman have been unable to locate any specimen of it preserved by Lamarck. In fact, they have informed me that apparently no herbarium specimens were preserved of many species described from living plants in the Jardin du Roi. It is, therefore, wholly unsafe to identify the large shrub and tree with cordate-ovate leaves, which Wiegand treats as *A. canadensis,* with *Crataegus racemosus* Lam. Similarly, *Mespilus nivea* Marsh. Arbust. 90 (1785) is altogether too vague, unless an original specimen of it can eventually be discovered. Its transfer into *Amelanchier* would merely lead to the doubt which surrounds so many names unfortunately taken up from Marshall's inadequate and often merely impressionistic accounts. *Crataegus amoena* Salisb. was illegitimate, merely a substitute for *Mespilus canadensis* L.

The first clear account of the tree or large shrub called by Wiegand *Amelanchier canadensis* was that of *Mespilus canaden-*

sis, var. *β. cordata* Michx. Fl. Bor.-Am. i. 291 (1803). Michaux divided *M. canadensis* into four varieties: Var. *α. obovalis,* the dwarf stoloniferous shrub of the Coastal Plain from Georgia to southeastern Virginia; var. "*β. cordata:* arborea: foliis cordato-ovalibus, conspicue acuminatis . . . a Canada ad Virginiam et in montibus Carolinae"; var. *γ. rotundifolia:* arborescens, etc. "in Canada"; and var. *δ. oligocarpa:* "in America boreali". In 1810, the younger Michaux, evidently taking the name from his father's first word of diagnosis, elevated *M. canadensis,* var. *cordata* to specific rank as *M. arborea* Michx. f. Hist. Arb. Am. Sept. iii. 68, t. 11 (1810). The beautiful plate, with cordate-oval serrate and acuminate leaves, flowers with long petals, and fruits with short and tightly reflexed calyx-lobes, is conclusive; so are the diagnosis, emphasizing the characters, "*foliis subovalibus, acutissime serratis, subacuminatis; adultis glabris*", and the fuller account of its attaining in favorable situations "une élévation plus grande, mais qui cependant n'excède pas 35 à 40 pieds (11 à 13 mètres) sur 10 à 12 pouces (26 à 32 centim.) de diamètre" and "Les feuilles . . . dans le commencement de leur développement, couvertes d'une duvet argentin, très-épais, mais qui disparoît à mesure qu'elles deviennent plus grandes." Here, then, is the first perfectly clear name for *Amelanchier canadensis* sensu Wiegand. Most unfortunately the combination based upon the very appropriate name, *Mespilus arborea,* has to be here made.

Amelanchier **arborea** (Michx. f.), comb. nov. *Mespilus arborea* Michx. f. Hist. Arb. Am. Sept. iii. 68, t. 11 (1810). *Mespilus canadensis* L., var. *β. cordata* Michx. Fl. Bor.-Am. i. 291 (1803). *A. canadensis* sensu Wiegand in Rhodora, xiv. 150, pl. 96, fig. 6 (1912), not *Mespilus canadensis* L., basinym. A portion of the original plate of *M. arborea* is reproduced as our plate 672, fig. 2.

In southeastern Virginia the expanding flowers of *Amelanchier arborea* are commonly suffused with pink, especially on the lower faces of the petals; farther north the petals are more definitely white.[1] Except for this color I can find no other difference.

The third species in southeastern Virginia with fastigiate shrubby habit is near *Amelanchier canadensis* (*A. oblongifolia*),

[1] In Va. Journ. Sci. ii. 118 (1941), Dr. Allard records the pink-flowered form from Loudon County.

but with short, oval to obovate leaves coarsely toothed at summit but less so along the margin below, and with compact and short racemes, the calyx-lobes in fruit spreading-ascending or scarcely recurved. This closely matches an isotype of *A. austro-montana* Ashe in Journ. Elisha Mitchell Soc. xxxiv. 138 (1918), described from the valley of French Broad River in extreme southwestern North Carolina.

Another tall shrub awaits better material. This is a shrub of pine-barren swamps, with nearly entire oblong leaves. Its flowers and fruits are unknown.

The last species to be considered illustrates as vividly as do *Amelanchier canadensis* and *A. arborea* the difficulty of undertaking monographic or revisionary work on a genus without most carefully checking the types or good photographs of the types. The dwarf stoloniferous and colonial shrub of southeastern Virginia, probably unknown to Wiegand in 1912, is superficially somewhat like *A. stolonifera* Wiegand (1912) of the northeastern states. The shrub of the Coastal Plain of southern Virginia, however, has very short and compact flowering racemes only 1–2.5 cm. long, with very short pedicels, which in fruit lengthen to only 3–8 mm. The calyx is tomentose during anthesis, the short calyx-lobes divergent after anthesis. The leaves are at first more or less white-pubescent beneath but soon glabrate, elliptic-oblong or oblong-oval to oblong-obovate, in maturity ranging from 2 cm. long and 1 cm. wide to 5.5 cm. long and 3 cm. broad and with small teeth extending along the margin. It ranges from Georgia to southeastern Virginia and was described by Michaux in his Flora Boreali-Americana, i. 291 (1803) as *Mespilus canadensis*, "Var. α. *obovalis:* humilior; foliis oblongiuscule obovalibus . . . in Carolina inferiore." Specimens before me from both North and South Carolina ("Carolina inferiore") are clearly Michaux's plant. The photograph of it, which I took at Paris in 1903 and which has been in the organized material in the Gray Herbarium for 38 years, shows it to bear Michaux's original label "*Mespilus canadensis* α. *obovalis.* Arbriss[eau] de deux pieds de haut. Carolines." This photograph[1] of Michaux's type of a Carolina shrub "2 feet high" was

[1] Like so many of Michaux's collections, material of different things was mounted (by someone else) unintelligently with one label; but most of the material clearly belongs with the label and with Michaux's description.

labeled by Wiegand during his revision of the genus in 1912, "May be an extreme form of *Amelanchier oblongifolia* (T. & G.) Roem."; but by Small (*Man.*) the southern dwarf and colonial species is merged with the dwarf and colonial northern *A. stolonifera* Wiegand (1912). If Small's merging of the two should seem to some correct, then Wiegand's name of 1912 must be set aside. Michaux's original diagnosis of his *M. canadensis*, var. *obovalis*, "humilior; foliis oblongiuscule obovalibus" for a shrub "2 feet high" was quite satisfactory and in sharp contrast with that of the next variety "*β. cordata:* arborea; foliis cordato-ovalibus, conspicue acuminatis," which soon became *Mespilus arborea* Michx. f.

Nevertheless, in discussing his all-inclusive *A. canadensis* in the Silva of North America (all-inclusive because uniting as a single species true *A. canadensis*, *Mespilus arborea* Michx. f., the boreal *A. Bartramiana* (Tausch) Roem., and others) Sargent made the new combination *A. canadensis*, var. *obovalis* Sargent, Silva, iv. 128 (1892),[1] based upon Michaux's South Carolina *Mespilus canadensis*, var. *α. obovalis*, the stoloniferous "shrub 2 feet high," Sargent saying "The most distinct of these forms is *Amelanchier Canadensis*, var. *obovalis*. This is a tree sometimes twenty-five or thirty feet in height, with a single stem or often with a cluster of spreading stems. . . . This variety is found in Nova Scotia and New Brunswick . . . and is abundant in Quebec and Ontario, extending northward to the valley of the Mackenzie River . . .; ranging southward along the Allegheny Mountains to Virginia . . . and occasionally occurs, much reduced in size, in the southern coast region from Bluffton, South Carolina, to the shores of the Bay of Mobile." Only the extreme southern "much reduced" shrub secondarily mentioned by Sargent belongs to var. *obovalis* sensu stricto!

[1] Although in 1892 Sargent made the combination *Amelanchier canadensis*, var. *obovalis* (Michx.) Sargent in correct form, citing the basinym with full bibliographic reference, the same combination, inadequately supported by reference to the basinym and with the wrong synonym cited, was published in their always doubtfully adequate bibliography by Britton, Stern & Poggenberg in their Preliminary Catalogue of Anthophyta and Pteridophyta, 17 (1888), as follows:

"Amelanchier, Lindl.
Canadensis, (L.), Medikus (fide Steudel.)
var. obovalis, (Michx.) (*var. oblongifolia, T. & G.*)"

Michaux's place of publication was not cited (that was left to others to hunt for), and "var. *oblongifolia*" was evidently meant to define the identity of var. *obovalis*.

Not until Ashe made the combination *Amelanchier obovalis* (Michx. f.) Ashe in Bot. Gaz. xxxv. 434 (1903), based upon *Mespilus canadensis,* var. α. *obovalis* Michx., did clarification of the species begin; but it merely began, for, although Ashe described a Coastal Plain "shrub 9–15 dm. high", he also included, somewhat like Sargent, "a small tree . . . attaining a maximum height of about 4.5 m." What the latter is I cannot say without access to Ashe's material. In southeastern Virginia such a tall shrub or small tree would be *A. austro-montana* Ashe (1915) which was originally described as up to 4 m. high. Whether the Clayton material described by Gronovius "foliis obverse-ovatis" and a secondary element of the Linnean species, belongs in *A. austro-montana* or in *A. obovalis* cannot just now be determined, the Gronovian plants being at present stored underground in England and practically inaccessible. Since no name was based on this material its identity is relatively unimportant, but the further account by Gronovius of it as "Frutex . . . humilis, . . . foliis subrotundis, eleganter serratis, & ad apicem rotundis", at least piques the imagination!

In southeastern Virginia the following species of *Amelanchier* are now recognized.

Amelanchier canadensis (L.) Medicus, as to type. *Mespilus canadensis* L., the type shown in our plate 672, fig. 1. *A. canadensis β. oblongifolia* Torr. & Gray. *A. oblongifolia* (Torr. & Gray) Roemer and later authors, including Wiegand in Rhodora, xiv. 147, pl. 96, fig. 5 (1912).—Common in eastern Virginia (many nos.).

*A. austro-montana Ashe. Surry County: peaty thicket east of Surry Courthouse, no. 9948; dry pine and oak woods about 3 miles northwest of Surry Courthouse, no. 13,039; at foot of wooded bluff by James River, above Scotland, no. 13,041. Southampton County: dry woods north of Sebrell, no. 7869; wooded swamp about 7 miles south of Franklin, no. 9949; low woods southeast of Little Texas, no. 11,700. Nansemond County: sandy woods and thickets south of Cleopus, no. 13,040. See p. 486.

A. arborea (Michx. f.) Fernald. Common (many nos.). A portion of the original plate of Michaux filius is shown in our plate 672, fig. 2.

*A. obovalis (Michx.) Ashe, as to type, *Mespilus canadensis,* var. α. *obovalis* Michx. Prince George County: dry sandy pine woods about 3 miles southeast of Petersburg, on head-

waters of Blackwater River, no. **5790**; argillaceous and siliceous boggy depression southeast of Petersburg, at head of Poo Run, no. **9947**. SUSSEX COUNTY: pinelands 3–4 miles northwest of Waverly, nos. **7072**, **7870** and **13,042**; dry sandy pine woods northwest of Homeville, no. **7073**. SOUTHAMPTON COUNTY: moist peaty and sandy depressions in pine barrens, south of Franklin, no. **7448**. GREENSVILLE COUNTY: argillaceous clearing near Readjuster Bridge over Nottoway River, north of Orion, no. **13,043**; mossy pineland east of Slagle's Pond, north of Emporia, no. **11,847**. ISLE OF WIGHT COUNTY: dry sandy pine barrens and open woods, south of Lee's Mill, no. **11,846**. NANSEMOND COUNTY: low pineland east of Whaleyville, no. **7449**; pine woods south of Suffolk, no. **7074**. A flowering tip from no. **7072** and a fruiting branch from no. **9947**, both $\times$ 1, are shown in PLATE 672, FIGS. 3 and 4; my photograph of Michaux's type (quite like our FIG. 4) being too poor for reproduction. See p. 505.

*POTENTILLA MILLEGRANA Engelm. HENRICO COUNTY: waste places and railroad ballast, Richmond, no. **12,363**. See p. 510.

Native from the Prairie States westward; obviously adventive.

*P. REPTANS L. ISLE OF WIGHT COUNTY: forming extensive carpets back of the beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. **12,664**. See p. 525.

Extension south from New Jersey and Pennsylvania.

*RUBUS PROCERUS P. J. Muell. HENRICO COUNTY: waste places and roadsides, Richmond, no. **12,111**.

Spread abundantly from cultivation.

R. TRIVIALIS Michx. DINWIDDIE COUNTY: thicket bordering freight-yard of Atlantic Coast Line, Petersburg, no. **12,108**.

Slight northwestern extension from easternmost counties. See p. **493**.

R. BAILEYANUS Britton; See Bailey, Gent. Herb. ii. 324 (1932) and ibid, i. fig. 112 (1925). PRINCESS ANNE COUNTY: trailing in dry field, Virginia Beach, *Fernald & Griscom*, no. **4430**.

Very similar to the Williamsburg material cited by Bailey.

*R. (§ PROCUMBENTES) **plexus,** sp. nov., procumbens ramosissimus ramibus prolongatis valde implicatis; primocannis adscendentibus angulatis glabris remote aculeatis aculeis vix retrorsis; floricannis prostratis subteretibus duris glabris divergenter aculeatis, aculeis 5 mm. longis rectis subremotis (20–30 per dm.); primocannae foliis (immaturis) 3–5-foliatis juvenilibus strigoso-pilosis glabratis, foliolis anguste ovatis acuminatis;

floricannae foliis ternatis, foliolis lanceolato-ovatis membranaceis serrato-dentatis acuminatis glabris vel glabratis; inflorescentiis corymbiformi-racemosis 3–5-floris rachi subglabra; pedicellis rectis filiformibus minute pilosis sparse setosis imis 3–4 cm. longis; calycis lobis reflexis ovatis minute pilosis 5 mm. longis; petalis roseis vel roseo-albidis obovatis 1.3 cm. longis 0.9 cm. latis.—Princess Anne County, Virginia: trailing in wooded swamp, east of Little Creek, May 4, 1935, *Fernald & Griscom*, no. 4432 (distrib. as *R. flagellaris* Willd.), type in Herb. Gray.

Rubus plexus, most absurdly distributed as *R. flagellaris* (for fear of describing a new species in the genus), has the very complicated branching suggestive of the northern *R. severus* Brainerd. Its true relationship is not clear and must await fuller material for elucidation. It abounds in the border of the wooded swamp south of the shore-road from Cape Henry westward, very near the large station of *Galax*. In early May it was attractive to look at (but not to collect) on account of its roseate petals; and subsequently Griscom and I saw it in a wooded swamp west of Pungo. It is not very closely related to any recognized species of § *Procumbentes*.

*R. invisus (Bailey) Britton. Sussex County: trailing on dry roadside bank at border of woods west of Homeville, no. 11,860. Southampton County: arching and tip-rooting, steep wooded banks, ravines and clearings near Three Creek, northwest of Applewhite's Church, no. 11,857. Greensville County: trailing and tip-rooting at border of rich deciduous wooded slope by Three Creek, slightly above the "fall-line", northwest of Emporia, no. 11,849.

Extension south from central-western New York. The specimens seem inseparable from an isotype in the Gray Herbarium and from the illustration in Bailey, Gent. Herb. iii. 263, fig. 139 (1934).

R. centralis Bailey. Dinwiddie County: thicket bordering waste ground and cinders of freight-yard of Atlantic Coast Line, Petersburg, no. 12,109.

Extension south from Stafford County and from the Eastern Shore of Maryland. See p. 493.

R. Grimesii Bailey. Local range extended into Southampton County: dry sandy roadside thicket south of Sunbeam, no. 12,103.

Fruit ripe in early June, of rich flavor and very juicy; worth cultivating. See p. 512.

R. Janssonii Bailey. To the single station in Sussex County, recorded in 1940, add one in Isle of Wight County: disturbed white sand of dry pine barrens, south of Lee's Mill, no. 12,370.

*Rubus (§ Hispidi) **ambigens,** sp. nov., valde arcuans deinde prostratus; primocannis laxe adscendentibus retrorse aculeato-setosis vix glandulosis, aculeis subsparsis (100–200 per dm.) setis parvis intermixtis; floricannis prostratis ramosissimis apicibus radicantibus sparse aculeatis; primocannae foliis firmis vix coriaceis subtus griseo-pilosis supra sparse pilosis quinatis, petiolo 3–7 cm. longo piloso aculeato, foliolis obovatis abrupte breviterque acuminatis serrato-dentatis, foliolo terminali basi rotundo-subcuneato 5.5–8 cm. longo 3–4.5 cm. lato petiolulo piloso retrorse-aculeato eglanduloso 1–2 cm. longo; floricannae foliis ternatis, foliolis elliptico- vel rhomboideo-obovatis sub-acutis argute serratis utrinque pilosis; inflorescentiis corymbi-formi-racemosis vel cymosis rhachi pedicellisque minute pilosis pedicellis plus minusve setosis; calycis lobis reflexis pilosis 3.5–5 mm. longis; fructibus vix 1 cm. diametro.—Norfolk County, Virginia: wet, peaty clearings in woods of *Pinus serotina,* south of Grassfield, June 11, 1940, *Fernald & Long,* no. 12,098 (type in Herb. Gray; isotype in Herb. Phil. Acad.).

Rubus ambigens, the fruiting canes of which form extensive prostrate carpets in the wet peat and clearing, is superficially so like *R. vigil* Bailey, Gent. Herb. i. 251, fig. 116 (1925) that, without examination, it would pass for that species. As originally described *R. vigil* is a plant with leaves glabrous except along the nerves beneath; "canes . . . so thickly beset with sharp stiff retrorse prickles . . . as to give them a shaggy look . . . bristles more or less gland-bearing". In Bailey's latest treatment, Gent. Herb. v. 71 (1941), the only way to reach *R. vigil* by his key is under the call "EE. Axis of primocanes conspicuously glandular-hairy", under which *R. vigil* is the first species. The detailed description of the species on p. 86, however, says "canes . . . glandless". It is very easy to understand Bailey's statement (p. 69) that "Species of the Hispidi are particularly difficult to place in a key of contrasts, for the easy aid of the student confronted with the problem of identification". However, the original description and the specimens cited show glabrous leaves, and all specimens which I have seen have

glandular canes. *R. ambigens,* although habitally resembling *R. vigil,* is, so far as we know, quite glandless, but its expanding primocane-foliage is whitish with dense pubescence, the mature foliage of both primocane and floricane pilose on both surfaces, softly so beneath.

R. pernagaeus Fernald. To the original station in Isle of Wight County (additional nos. 11,848 and 12,101) add one in Sussex County: border of dry woods near Assamoosick Swamp, about 2 miles northeast of Homeville, no. 11,852.

R. cuneifolius Pursh.

Typical *R. cuneifolius,* with truly cuneate leaflets of the floricane-foliage and the primocane-leaves with 5 cuneate leaflets subtruncate but abruptly short-pointed at summit, is rare in southeastern Virginia. There the primocane-foliage is mostly 3-foliolate and the leaflets are more curved on the sides. These plants form a transition to the more extreme variation noted below. I am temporarily leaving them in *R. cuneifolius,* as follows:

James City County: opening in flat oak woods west of Williamsburg, *Grimes,* no. 3056. Sussex County: border of dry woods northeast of Homeville, no. 12,106; sandy, mossy swale northeast of Belsches, *Wiegand & Manning,* no. 1405.

Similar material is in the Gray Herbarium from Wake and Durham Counties, North Carolina. The most extreme departure from typical *Rubus cuneifolius* is

*R. cuneifolius Pursh, var. **subellipticus,** var. nov., primocannae foliis 3- vel 5-natis; floricannae foliolis elliptico-obovatis vix cuneatis.—Southeastern Virginia: sandy pine woods along Wakefield Road, northeast of Sebrell, Southampton County, *Fernald & Long,* no. 10,675, distrib. as *R. cuneifolius* (type in Herb. Gray).

R. Longii Fernald. The common representative of *R. cuneifolius* in southeastern Virginia, the type-material with floricanes arched-ascending to trailing. New collections show it to vary from depressed or trailing shrubs to arching, and in dune-areas to be stiffly erect. All these nos. (from Elizabeth City, York, James City, Princess Anne, Norfolk, Surry, Sussex and Southampton Counties) are consistent in the broadly ovate or obovate to suborbicular gradually acuminate leaflets of the primocane-foliage and the elliptic to ovate or rounded leaflets of the floricanes. See p. 512.

Photo. W. H. Hodge.

LESPEDEZA CAPITATA, var. VULGARIS: FIG. 1, summit of flowering stem, × 1; FIG. 2, portion of flowering head, × 4; FIG. 3, portion of fruiting head, × 4; FIGS. 4 and 5, lower and upper surface of leaf, × 10; FIG. 6, legumes, × 4, from base of fruiting calyx.

Photo. W. H. Hodge.

Lespedeza capitata, var. calycina: fig. 1, summit of isotype, × 1; fig. 2, portion of fruiting spike, × 4; fig. 3, lower surface of leaf, × 10; fig. 4, median cauline leaves, × 1.

*R. probabilis Bailey. Southampton County: sandy thicket southeast of Branchville, no. 10,284, shrubs freely branched, the tall canes arching and root-tipping.

Extension north from North Carolina.

*R. floridus Tratt. Nansemond County: wooded bottomland of a branch near Cathole Landing, west of Factory Hill, no. 11,854, erect to arching, very tall. Southampton County: dry sandy pine woods by Nottoway River, near Carey Bridge, no. 11,859. See p. 490.

Rubus floridus has been unknown except for the type described by Trattinnick from a collection made in the South by Enslen. According to Bailey, Gent. Herb. iii. 125, 126 (1933) it is otherwise unknown. Our collection of no. 11,854, from an extensive colony (within a mile of the North Carolina line), seems to be a very close match for the illustrations of Trattinnick's type published by Bailey in Gent. Herb. i. 194 and 195 as figs. 89 and 90. No. 11,859 has narrower floricane-leaflets and glandless pedicels; it is, perhaps, not properly placed with no. 11,854.

Alchemilla microcarpa Boiss. & Reut. To the few stations noted by me in 1938 add the following. Sussex County: ledges by foot-path in rich woods at the "fall-line" along Nottoway River, above Double Bridge, about 6 miles northwest of Jarratt, nos. 11,701 and 12,112 (mature plants up to 1.5 dm. high). Southampton County: weed in lawn of courthouse; Courtland, no. 11,861. Greensville County: lawns and grassland, Emporia, no. 11,702. See p. 489.

*Rosa multiflora Thunb. and its hybrids. Spread from cultivation to thickets, borders of woods, etc., several nos.

*Trifolium pratense L., forma leucochraceum Aschers. & Prantl. Dinwiddie County: waste ground and cinders of freight-yard of Atlantic Coast Line, Petersburg, no. 12,375.

T. reflexum L. Sussex County: open thickets and clearings near Nottoway River at Readjuster Bridge, south of Peanut, nos. 12,117 and 12,118. See p. 501 and map 5.

*Medicago minima L., var. longiseta DC. Elizabeth City County: Fortress Munroe, May 2, 1894, *J. R. Churchill* (distrib. as *M. maculata*).

*M. minima L., var. compacta Neyraut. York County: abundant at intervals for several miles, sandy beach and open fields above Yorktown, no. 12,119. See p. 505.

*Psoralea canescens Michx. Sussex County: dry white sand of woods and clearings near Chub, nos. 12,378 and 12,671.

Extension north from South Carolina; only a few plants. See p. 506 and map 6.

Desmodium grandiflorum (Walt.) DC. (*D. bracteosum* (Michx.) DC.). Surry County: rich calcareous wooded ravines west of Claremont, no. 12,674. See p. 520.

Recorded by Merriman in his Flora of Richmond. Certainly very local in eastern Virginia. Although the name *D. grandiflorum* (Walt.) DC. has been taken up by Small and others on the basis of Blake's note in Bot. Gaz. lxxviii. 277 and 278 (1924), there is no material of this species in the Gray Herbarium from south of Virginia and the mountain-region of western North Carolina. It would be gratifying to see specimens from Walter's territory and to have the comparison with Walter's type made by some one familiar with the North American species. Blake's note was based upon a comparison made by the late E. G. Baker, who could hardly have known the intricacies of the genus.

Some Varieties of Lespedeza capitata and L. hirta (Plates 673–682).—Although the purple-flowered series of American species of *Lespedeza* is perplexingly variable and often seems to cross indiscriminately, the whitish-flowered plants, especially *L. capitata* Michx. and *L. hirta* (L.) Hornem. are probably our most variable species. Each has a number of fairly recognizable varieties with pronounced geographic concentration; but the identifications in the herbarium show a large number of specimens with the characteristic racemes and fruits of *L. hirta* placed under *L. capitata* because of their relatively short peduncles. In attempting, rather unsatisfactorily, to clarify the group I have found it necessary to reassort the accumulated material in the Gray Herbarium and in the herbarium of the New England Botanical Club with regard for the rather definite characters of the raceme, calyx and legume, rather than by the names on the labels. True *L. capitata* (plate 673) has dense subcapitate spikes with the long calices closely overlapping and strongly ascending, so that the inner flowers of the head are quite hidden in maturity, and the legumes are greatly overtopped by the prolonged calyx-lobes; *L. hirta* (plate 678) has cylindric spiciform racemes, with the loosely ascending to divergent flowers not strongly imbricated, in fruit definitely separated, and

with the legume nearly equaling to overtopping the calyx-lobes. Unfortunately, in defining varieties under the two species authors have often failed to go back to original diagnoses and to types or isotypes, with the result that a realignment of varietal names becomes necessary. *L. angustifolia* (Pursh) Ell., at least as usually interpreted, for the type is not just now available, is closely allied to and sometimes united with either *L. hirta*[1] or with *L. capitata.* Although hybridizing with them, it seems to me almost as well defined as a species as most members of the genus; for this is a group in which interspecific hybridization is exceptionally frequent, associated as it is with the two types of inflorescence, showy petaliferous flowers and cleistogamous apetalous ones, with the result that crosses due to insect-pollination of the earlier and showy flowers seem to be carried on through the cleistogamous fruits, just as they are in *Viola.*

I am defining the three species as follows.

a. Racemes capitate-spiciform, very dense; the strongly appressed calices 7–13 mm. long, closely overlapping, with the inner ones mostly hidden, greatly exceeding the legume; peduncles very short, usually much shorter than the subtending leaves .... *L. capitata.*

a. Racemes cylindric, the ascending to divergent lower flowers not hiding those above; mature calyx 4–10 mm. long, nearly equaling to only slightly exceeding legume; peduncles shorter than to usually much longer than subtending leaves.

Principal leaves with petiolule of terminal leaflet 3–8 mm. long and conspicuously coarser and more pilose at summit; leaflets rounded-obovate to linear, 0.6–3.5 cm. broad; calyx 6–10 mm. long; bracteoles 2–4 mm. long .....*L. hirta.*

Principal leaves with petiolule of terminal leaflet 0.5–4 mm. long and not conspicuously modified at summit; leaflets linear, 2–6 mm. broad; mature calyx 4–6.5 mm. long; bracteoles 1–2 mm. long .... *L. angustifolia.*

Lespedeza capitata was first described by Michaux with an unequivocal diagnosis, as follows:

> CAPITATA. L. erecta: foliis subsessilibus; foliolis oblongis: capitulis sessiliter conglomerato-terminalibus: legumine intra calycem multo majorem recondito.
> *Hab.* in Virginia et Carolina.
> —Michx. Fl. Bor.-Am. ii. 71 (1803).

[1] *L. hirta,* var. *angustifolia* (Pursh) Maxim. in Act. Hort. Petrap. ii. 379 (1873).

It has been customary to treat as typical *Lespedeza capitata* the wide-ranging plant (PLATE 674) with round-tipped or obtuse oblong leaflets appressed-pubescent beneath with opaque or only slightly lustrous hairs, and green above, the capitate spikes often overtopped by their subtending leaves, the plant occurring from west-central Maine to Minnesota and Nebraska, entering the southern corners of Quebec and Ontario, thence south through the northeastern and central states and locally to the mountains of North Carolina[1] and into Missouri, the plant called by Torrey & Gray *L. capitata, β. vulgaris;* while a plant of similar habit, but with leaves brilliantly silvery beneath and grayish to silvery and lustrous above and with the densely crowded upper spikes mostly overtopping their subtending leaves, was described from Louisiana as *L. capitata, β. sericea* by Hooker & Arnott in Hooker's Comp. to Bot. Mag. i. 23 (1835).

Var. *sericea* (PLATE 673) abounds on the Coastal Plain of the Southern States, from Texas to Georgia, thence northward to Nebraska, Iowa, Wisconsin and Indiana, and on the Atlantic Coastal Plain and outer Piedmont locally to Massachusetts, our representation of it from eastern North Carolina being 10 numbers, from eastern Virginia 5. The common northern and inland plant with only sublustrous to opaque foliage and rather leafy inflorescences (var. *vulgaris*) shows 2 collections from eastern Virginia, none from eastern North Carolina. It is, therefore, not surprising to find on inspection of the photograph of Michaux's type (taken by me in 1903) that his species from "Virginia and Carolina" is the common plant of the eastern sections of those states, i. e. var. *sericea* Hook. & Arn. (our PLATE 673). This interpretation is supported by Poiret's full description of the Michaux type. Renaming it *Hedysarum conglomeratum* Poir. in Lam. Encycl. vi. 416 (1804), he described the "folioles . . . oblongues, luisantes, soyeuses. . . . Les fleurs sont réunies, à l'extrémité des tiges & des rameaux, en petits paquets agglomérés & en tête, pourvues de pédoncules partiels très-courts." Michaux's material in *Lespedeza*, like that in many other groups, was mounted by some one else without much, if any, regard to the diagnoses. The sheet containing the label "*Lespedeza capitata*" has five stems mounted upon it. That at the

[1] In September, 1941, found in southeastern Virginia.

right closely matches the original diagnosis and must stand as the TYPE. To the left (in the middle of the sheet) are two stems of the extreme of *L. hirta* which has been called by different authors *L. longifolia* DC., *L. capitata* var. *longifolia* (DC.) Torr. & Gray, *L. hirta* var. *oblongifolia* Britton and *L. oblongifolia* (Britton) Stone; while at the extreme left are two stems of *L. angustifolia* (Pursh) Ell. That the mixture was not made by Michaux himself is evident from his very clear diagnosis.

It has been customary to recognize one of the extremes of *Lespedeza capitata* with narrowest leaflets as var. *longifolia* (DC.) Torr. & Gray. When, however, the basinym, *L. longifolia* DC. Prodr. ii. 349 (1825), is studied it is evident that DeCandolle had a southern Coastal Plain extreme of *L. hirta*. He correctly described *L. capitata* "spicis capitatis brevè pedunculatis axillaribus et conglobato-terminalibus, calycibus villosis longitudine corollae legumine multò longioribus"; but his new *L. longifolia*, with oblong leaflets, differed: "racemis [nec spicis] fasciculato-corymbosis multifloris axillaribus et subterminalibus, legumine calycis lobis acuminatis breviore." Although I have not examined the type of *L. longifolia*, DeCandolle's description so strongly suggests a rare Coastal Plain extreme of *L. hirta*, which occurs in Louisiana, that I do not see how to separate it from *L. hirta* var. *oblongifolia* Britton, described from the Pine Barrens of New Jersey.

The restoring of *Lespedeza capitata* var. *longifolia* (DC.) Torr. & Gray, as to basinym at least, to varietal rank under *L. hirta* necessitates finding a name for the rather rare extreme of *L. capitata* with narrowly oblong to lance-linear leaflets commonly silky beneath and often above. Although *L. capitata* var. *stenophylla* Bissell & Fernald in RHODORA, xiv. 92 (1912) was thought, when published, to be well separable from the plant then passing as var. *longifolia*, it may be extended to cover that variable series (PLATE 676).

The varieties of *Lespedeza capitata*, as I now see them, are as follows.

a. Lower surfaces of leaves with closely appressed or sericeous pubescence . . . *b*.
 b. Leaflets oblong, elliptic, oval or obovate . . . *c*.
  c. Leaflets oblong to narrowly elliptic; heads crowded and very short-peduncled among the upper leaves.

Leaves brilliantly silvery beneath, grayish and lustrous above; upper heads closely aggregated and mostly hiding the subtending leaves .... *L. capitata* var. *typica.*
Leaves opaque or only slightly lustrous beneath, green above or soon becoming so; subtending leaves most often exceeding the heads; northern .... Var. *vulgaris.*
c. Leaflets broadly elliptic-oval to rounded-obovate; some or all peduncles scattered and equaling or exceeding the subtending leaves; southern .... Var. *calycina.*
b. Leaflets lance-oblong or lanceolate to lance-linear, usually sericeous, at least beneath .... Var. *stenophylla.*
a. Lower surfaces of oblong to narrowly obovate leaflets densely velvety-pilose with dull to sublustrous cinereous to fulvous pubescence; inflorescence leafy; northeastern. Var. *velutina.*

L. capitata Michx., var. **typica.** *L. capitata* Michx. Fl. Bor.-Am. ii. 71 (1803). Var. *sericea* Hook & Arn. in Hooker's Comp. to Bot. Mag. i. 23 (1835). *Hedysarum conglomeratum* Poir. in Lam. Encycl. vi. 416 (1804).—Eastern Texas to Georgia, north to Nebraska, Minnesota, Wisconsin, Tennessee and eastern Massachusetts. The following, selected from many numbers, are characteristic. Massachusetts: near Cottage Farm, Boston, August 7, 1879, *C. E. Perkins;* Dedham, August 22, 1903, *A. W. Cheever;* Blue Hill, Milton, September 1, 1887, *Faxon;* Darby Station, Plymouth, *Fernald, Hunnewell & Long,* no. 9746; Wareham, *Fernald & Long,* no. 9748; New Bedford, *E. W. Hervey;* Centerville, August 12, 1900, *Clara Imogene Cheney;* Yarmouth, *Fernald & Long,* no. 9747; Eastham, *F. S. Collins,* no. 528; Uncatena, Dukes Co., *Fogg,* no. 3129; Ludlow, September 9, 1922, *Hunnewell.* Rhode Island: Meshanticut Park, Cranston, August 23, 1908, *T. Hope;* Watchaug Pond, Charlestown, *Pease & Griscom,* no. 24,010. Connecticut: Vernon, September 23, 1888, *Chas. Wright.* New York: 2 miles northeast of Hicksville, Nassau Co., September 6, 1907, *R. M. Harper.* New Jersey: Lakewood, *Hunnewell,* no. 6926; Cape May, *Gershoy,* no. 383. Pennsylvania: mouth of Tucquan, Lancaster Co., *Heller & Halbach,* no. 528. Virginia: Little Neck, Princess Anne Co., *Fernald & Long,* no. 4907; north of Factory Hill, Nansemond Co., *Fernald & Long,* no. 9586; west of Wiggins School, south of Franklin, *Fernald & Long,* no. 11,360. Virginia or North Carolina: type of species, *Michaux* (photograph in Gray Herb.). North Carolina: near Gatesville, Gates Co., *Godfrey,* no. 7045; near Williamstown, Martin Co., *Godfrey,* no. 7023; Middlesex, Nash Co., *Godfrey & Kerr,* no. 6637; near Edward, Beaufort Co., *Godfrey & White,* no. 6881; near Grantsboro, Pamlico Co., *Godfrey & White,* no. 6810; near Ft. Barnwell, Craven Co., *Godfrey & White,* no. 6781. South Carolina: 5 miles south of Andrews, Georgetown Co., *Godfrey,* no. 8186. Georgia: Nacooche Valley, Habersham Co., September 17, 1883,

J. D. Smith. TENNESSEE: Knoxville, *Ruth,* no. 312. ALABAMA: Perdido, *Blanton,* no. 7082; northeast of Autaugaville, Autauga Co., *Harper,* no. 3128. MISSISSIPPI: Ocean Springs, *Skehan,* no. 2422. WISCONSIN: Fountain City, Buffalo Co., *Fassett & Wilson,* no. 4392. ILLINOIS: Evanston, August 16, 1911, *Sherff;* Champaign, *Pease,* no. 12,413; north of Princeville, August 18, 1896, *V. H. Chase;* Sugar Creek Ravine, *Robert Ridgway,* no. 92. ARKANSAS: northwestern Arkansas, September, 1882, *F. L. Harvey.* LOUISIANA: without stated locality, *Hale.* MINNESOTA: west of Brainerd, Crow Wing Co., *Hotchkiss & Jones,* no. 472. IOWA: Ames, *Ball,* no. 16. NEBRASKA: Halsey, Thomas Co., *Rydberg,* no. 1746. KANSAS: Riley Co., *Norton,* no. 114 (transition to next var.). OKLAHOMA: Shattuck, Ellis Co., *G. W. Stevens,* no. 2929. TEXAS: west of Alvin, Brazoria Co., *Cory,* no. 11,390. PLATE 673.

*Var. VULGARIS Torr. & Gray, Fl. N. Am. i. 368 (1840), as to description and plant of "Canada and New England States!"—West-central Maine and southern Quebec to Minnesota and Nebraska, south to North Carolina and Missouri. The following from about ten times as many specimens examined are characteristic. QUEBEC: Ottawa River, Baie Sherley, *Rolland-Germain,* no. 19,282. MAINE: Moose Hill, Livermore, 1894, *Kate Furbish;* Topsham, August 28, 1913, *Furbish;* Limington, *Fernald, Long & Norton,* no. 13,964. NEW HAMPSHIRE: Lake Ossipee, Freedom, Carroll Co., *Pease,* no. 25,827; Dover, *Hodgdon,* no. 2374; Derry, Rockingham Co., August 30, 1916, *C. F. Batchelder;* Hollis, Hillsborough Co., August 21, 1932, *Batchelder;* Hinsdale, Cheshire Co., August 23, 1919, *Batchelder;* Hampton, August 31, 1902, *Williams.* VERMONT: Brattleboro, September 16, 1912, *L. A. Wheeler.* MASSACHUSETTS: Newbury, *Pease,* no. 25,761; Lexington, November 13, 1892, *W. Deane;* Carlisle, August 23, 1884, *C. W. Jenks;* Bellingham, *Hunnewell,* no. 4982; Darby Station, Plymouth, *Fernald, Hunnewell & Long,* no. 9744; Edgartown, Martha's Vineyard, *Bicknell,* no. 5110; Sutton, *Anderson, Smith & Weatherby,* no. 2492; Grafton, September 22, 1921, *Knowlton;* Green Pond, Montague, *F. C. Seymour,* no. 3326; Southwick, *F. C. Seymour,* no. 226; Springfield, August 27, 1913, *Bissell & Weatherby.* RHODE ISLAND: Cumberland, September 13, 1903, *Williams;* Warwick, *Collins, Fernald & York,* no. 11,361; Great Salt Pond, Block Island, *Fernald, Hunnewell & Long,* no. 9742. CONNECTICUT: Franklin, September 29, 1906, *Woodward;* Waterbury, *Blewitt,* no. 1332; Milford, October 10, 1909, *H. S. Clark;* Stratford, *A. E. Carpenter,* no. 756. NEW YORK: Patten's Mills, between Washington and Warren Cos., August 9, 1896, *Burnham;* Narrows Island, Black Lake, St. Lawrence Co., *Fernald, Wiegand & Eames,* no. 14,362; east of Owego, Tioga Co., *Wiegand,* no.

12,337. New Jersey: Delaware Valley, Sussex Co., September 15, 1917, *E. B. Bartram;* Manahawkin, Ocean Co., *Long*, no. 13,495; Somerdale, Camden Co., September 23, 1921, *Meredith.* Pennsylvania: Keller's Church, Bucks Co., August 24, 1923, *Benner.* Delaware: south of New Castle, *Tidestrom*, no. 11,515; near Centreville, September 28, 1875, *A. Commons;* Rehoboth, September 6, 1908, *Churchill.* District of Columbia: Washington and vicinity, September 7, 1896, *Steele.* Virginia: southeast of Stony Creek, *Fernald & Long*, no. 13,650. North Carolina: near Biltmore, *Biltmore Herb.* no. 586a; Great Smoky Mts., alt. 3000 ft., Swain Co., August 25, 1891, *Beardslee & Kofoid.* Indiana: Miller's, September 4, 1897, *Umbach.* Wisconsin: Hertel, Burnett Co., *Fassett*, no. 16,486; south of Wautoma, Waushara Co., *Fassett*, no. 16,707; southeast of Mauston, Juneau Co., *Fassett*, no. 17,143. Illinois: Catlin, Vermilion Co., *Lansing*, no. 3512 (transition to var. *typica*); Peoria, September, 1904, *McDonald;* Decatur, *Gleason*, no. 749. Minnesota: Center City, August, 1892, *B. C. Taylor;* Morrison Lakes, Clearwater Co., *M. L. Grant*, no. 3082 (transition to var. *typica*). Iowa: Fayette, August, 1894, *Fink;* West Branch, *Pennell*, no. 713. Missouri: Green Co., Sept. 7, 1893, *Blankinship* (transition to var. *typica*); Newton Co., *Bush*, no. 66 (transition to var. *typica*). Plate 674.

Var. **calycina** (Schindler), comb. nov. *L. hirta* var. *β. calycina* Schindler in Engler, Bot. Jahrb. xlix. 624 (1913). *L. capitata* var. *hirtiformis* Fernald in Rhodora, xl. 437, t. 524 (1938).—Southeastern Virginia to Florida, west to eastern Texas. Virginia: northwest of Whaleyville, Nansemond Co., *Fernald & Long*, no. 7481 (type of var. *hirtiformis*). North Carolina: near Ft. Barnwell, Craven Co., *Godfrey & White*, no. 6826. South Carolina: cited without specified locality by Schindler, l. c. collected by *Cabinis.* Florida: Jacksonville, *Curtiss* (cited by Schindler). Louisiana: without stated locality, *Hale.* Texas: Dallas, *Reverchon*, no. 288 (type). Plate 675.

Schindler placed this extreme from the southern Coastal Plain under *Lespedeza hirta* because of the shape of the leaflets and the peduncled spikes; but he noted that it differed in the only sparsely pilose or subglabrous and elongate calyx overtopping the sparsely pilose legume and in the whole plant being less pubescent than in the villous-stemmed *L. hirta*, all characters of *L. capitata.* I placed it under *L. capitata*, as var. *hirtiformis*, because, with the technical characters of spike, calyx and short legume of that species, it has the peduncles and outline of leaflets of *L. hirta!* Since Schindler designated no type of his

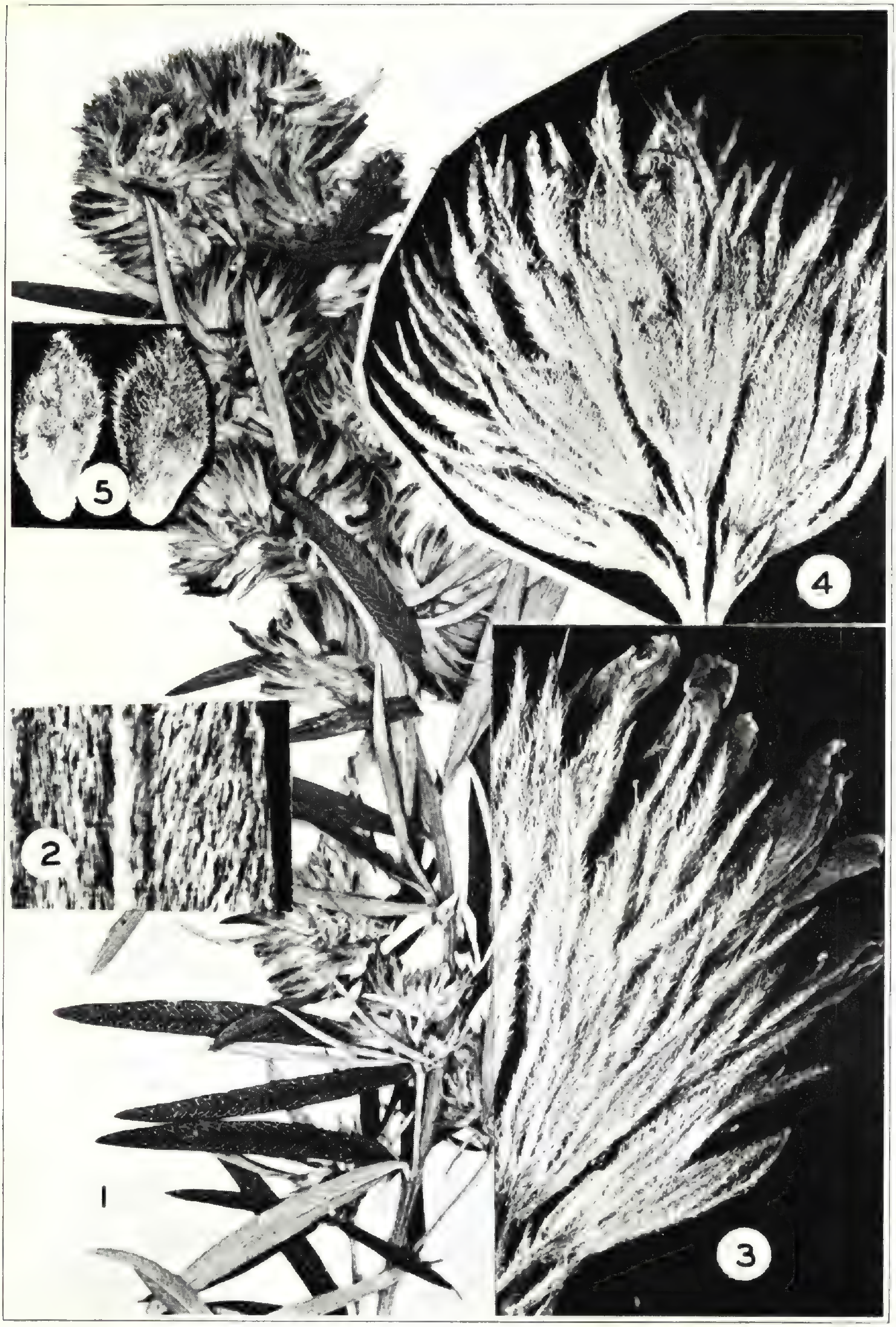

Photo. W. H. Hodge.

Lespedeza capitata, var. stenophylla: fig. 1, summit of type, × 1; fig. 2, lower surface of leaf, × 10; fig. 3, portion of flowering head, × 4; fig. 4, fruiting head, × 4; fig. 5, legumes from bases of fruiting calices, × 4.

Photo. W. H. Hodge.

Lespedeza capitata, var. velutina: fig. 1, flowering summit, × 1; fig. 2, median cauline leaves, × 1; fig. 3, lower surface of leaf, × 10; fig. 4, flowering head, × 4; fig. 5, portion of fruiting head, × 4; fig. 6, legumes from bases of fruiting calyx, × 4.

L. hirta var. *calycina*, the varietal name earlier than mine, I am designating as its TYPE Reverchon's no. 288 (our PLATE 675, FIGS. 1–3), which seems to have been the plant he had before him.

*Var. STENOPHYLLA Bissell & Fernald in RHODORA, xiv. 92 (1912). Leaflets linear-oblong, lanceolate or lance-linear, mostly sericeous beneath, green and glabrous or promptly glabrate above, acute or blunt; heads mostly scattered. Var. *longifolia* sensu most authors, not *L. longifolia* DC., basinym.—Local, Massachusetts to Virginia; southern Wisconsin and northwestern Indiana to northern Missouri. The following are characteristic. MASSACHUSETTS: summit of Blue Hill, Milton, September 8, 1891, *Faxon,* September 22, 1895, *Kennedy.* RHODE ISLAND: north of Ashaway, Hopkinton, September 1, 1919, *Fernald, Woodward & Collins.* CONNECTICUT: Franklin, August 22, 1914, *Woodward;* Glastonbury, September 17, 1911, *Bissell;* near Trading Cove Bridge, Norwich, September 15, 1904, *Graves.* NEW JERSEY: Borderville, Passaic Co., *Mackenzie,* no. 3889 (transitional). VIRGINIA: southeast of Stony Creek, *Fernald & Long,* nos. 13,646 and 13,649. WISCONSIN: north of Ridgway, Iowa Co., *Fassett & Graeber,* no. 16,711. INDIANA: Dune Park, *Greenman,* no. 2671; south of Fair Oaks, Jasper Co., *Deam,* no. 51,267; White Co., *Heimlich,* no. 739. ILLINOIS: Peoria, September, 1904, *F. E. McDonald* (TYPE), leaflets long-attenuate; Havana, August 17, 1903, *Gleason;* Champaign, *Pease,* no. 12,413 (leaflets blunt); Beardston, August, 1842, *Geyer.* MISSOURI: south of Graysville, Putnam Co., *Drouet,* no. 1830. PLATE 676.

Var. STENOPHYLLA, forma **argentea,** forma nov. foliis utrinque sericeo-argenteis.—ILLINOIS: sand dunes, Havana, August, 1903, *Gleason* (TYPE in Herb. Gray).

In var. *stenophylla* the head is often more elongated and more inclined to become spicate-racemose than in the other varieties. It thus approaches *Lespedeza hirta* and in immature specimens it is often difficult to be quite certain whether the plants are *L. capitata* var. *stenophylla* or the northern extreme of *L. hirta* (described below), which has almost the identical habit. Fully developed inflorescences and, preferably, fruit are important in distinguishing these two plants.

Var. VELUTINA (Bickn.) Fern. in RHODORA, x. 51 (1908). *L. velutina* Bicknell in Torreya, i. 102 (Sept., 1901), not Dunn (Feb., 1901). *L. Bicknellii* House in Torreya, v. 167 (1905). *L. Schindleri* Lévl. Cat. Pl. Yun-Nan, 159 (1916).—Central

Maine to eastern New York and northern New Jersey. The following, selected from many specimens, are characteristic. Maine: Orono, September 14, 1897, *Fernald;* Rumford, September 7, 1889, *Parlin;* Brunswick, September, 1903, *Furbish;* Cumberland, *Chamberlain,* no. 277; Wells, September 17–21, 1898, *Furbish;* North Berwick, September 13, 1894, *Parlin.* New Hampshire: by Connecticut River, Bath, Grafton Co., *Fernald,* no. 15,548; Haverhill, *Fernald,* no. 15,547; Pemigewasset River, Plymouth, *Fernald,* no. 11,789; Hooksett, Merrimack Co., August 16, 1925, *C. F. Batchelder;* Pelham, Hillsboro Co., October 11, 1902, *Knowlton;* Hinsdale, Cheshire Co., August 22, 1931, *Weatherby & Griscom.* Vermont: Colchester, *Blake,* no. 2103; Connecticut River, Vernon, *Raup & Weatherby* in Pl. Exsicc. Gray, no. 561; Pownal, *Eggleston,* no. 1111. Massachusetts: Lynnfield, August 18, 1880, *H. A. Young;* Horn Pond Mt., Winchester, October 20, 1901, *E. F. Williams;* Westwood, October 6, 1901, *B. L. Robinson;* Pembroke, September 6, 1920, *Churchill;* Wood's Hole, Falmouth, *Fernald & Weatherby,* no. 16,992; West Tisbury, *Fernald & Fogg,* no. 935; Chilmark, *F. C. Seymour,* no. 1427; Worcester, September, 1878, *E. W. Sargent.* Rhode Island: Warwick, *Collins, Fernald & York,* no. 11,362. Connecticut: Beach Pond, Voluntown, September 22, 1902, *Harger* (transition to var. *vulgaris*); Groton, October 10, 1901, *Graves;* Milford, October 18, 1896, *Eames.* New York: Little Neck, Long Island, July 31, 1853, *Hexamer & Maier.* New Jersey: Ringwood Junction, Passaic Co., *Mackenzie,* no. 3902 (unusually narrow leaves). Plate 677.

Typical *Lespedeza hirta,* at least as usually interpreted, for I cannot now secure a photograph of the type which was collected by Clayton in Virginia, is very definite: a tall plant (plate 678) with spreading pubescence on the stem, long-petioled leaves with rounded-obovate to rounded-oval or broadly oblong large leaflets pubescent, at least on the veins, beneath with spreading or loosely ascending hairs, its long-peduncled cylindric racemes spiciform but with the mature flowers and fruits only loosely ascending or spreading, not crowded into closely imbricated heads, and the legume nearly equaling or even exceeding the calyx. In the Southeastern States, from Florida to eastern North Carolina, and less characteristically into southeastern Virginia, var. *appressipilis* Blake is habitally like typical *L. hirta* but with the consistently small and thick leaflets cinereous beneath (often silvery) with minute appressed puberulence.

Of wider but interrupted range on or near the Coastal Plain, from Louisiana to southern New Jersey, there occurs a plant habitally like *L. hirta* and with quite similar racemes and flowers but with narrowly oblong leaflets. This is, as noted on p. 575, *L. longifolia* DC., described from Louisiana, the Louisiana plant seeming scarcely separable from *L. hirta* var. *oblongifolia* Britton, described from southern New Jersey. Whether the plant is of hybrid origin, as Britton suggested in Ill. Fl. ed. 2, ii. 407 (1913), can be determined only by further observation, for I have seen no fruit. The late Dr. Witmer Stone thought it a good species.

In southeastern Virginia there is an extreme with the long-peduncled open racemes and flowers of *Lespedeza hirta* but with leaflets nearly as narrow as in *L. angustifolia*. Its large calyx and long bractlets are those of *L. hirta*, its minute sericeous pubescence is that of *L. hirta* var. *appressipilis*, its leaflets nearly those of *L. capitata* var. *stenophylla*. It is possible to think, as Britton suggested regarding his *L. hirta* var. *oblongifolia*, that it is a hybrid of *L. angustifolia;* but that little species (PLATE 681, FIGS. 5 and 6), if correctly identified, with much smaller flowers and shorter and more compact spikes, has not been found at most of our known stations for the coarser plant. The latter might, likewise, be looked upon as a connecting link between *L. angustifolia* and *L. hirta*. Even so, *L. hirta*, having priority of specific epithet, it will serve convenience to give the large plant of Virginia a varietal name under that species.

Not only does *Lespedeza hirta* in one extreme strongly simulate *L. angustifolia* and possibly grade into it in the South; north of or at the northern outposts of any known form of *L. capitata* it strongly simulates that species. In New England typical *L. capitata*, with erect densely imbricated long fruiting calices, glistening sericeous foliage and short legumes, reaches very locally northward only into eastern Massachusetts; var. *vulgaris* is on the most sterile and arid soils northward to Androscoggin County, Maine, the Ossipee region of east-central New Hampshire and the southeastern corner of Vermont; while the strictly northeastern var. *velutina* alone reaches central Maine, northern New Hampshire and northern Vermont, and var. *stenophylla* reaches its isolated northeastern limit on a

weathered and leached sterile crest in Norfolk County, Massachusetts. In New England, furthermore, typical *L. hirta* is quite unknown northeast of the extreme southwestern corner of Maine and southernmost counties of New Hampshire. It is, consequently, noteworthy that along the richer river-valleys of northern and western New England there should be a velutinous and sericeous plant (PLATE 682) strongly suggestive of *L. capitata* var. *velutina* (PLATE 677) in its short-peduncled and compact spiciform racemes scattered in interrupted virgate and leafy inflorescences, but with the short calyx, less overlapping flowers and the nearly or quite exserted legume of *L. hirta*. In aspect it stands midway between *L. hirta* var. *longifolia* and *L. capitata* var. *velutina,* but it can hardly be a recent cross of these two, for the former doubtfully fertile plant reaches its northern limit in southern New Jersey. This singular plant of northern New England, standing somewhat between *L. hirta* var. *longifolia* and *L. capitata* var. *velutina,* is on the relatively rich terraces and banks of the Penobscot, Kennebec, Connecticut and Housatonic systems, and it apparently extends locally southward to Nantucket and Cape Cod. It seems also to occur in Wisconsin. On account of its flowers and fruit I am placing it tentatively under *L. hirta,* as an anomalous variety. It needs close attention in the field, for as yet we know only one fruiting collection.

The varieties of *Lespedeza hirta,* as I now interpret them, are as follows.

a. Peduncles mostly overtopping their subtending leaves; racemes relatively open, in fruit 1.5–4.5 cm. long . . . *b.*
- *b.* Leaflets rounded-obovate to oblong-ovate, the terminal one of the primary leaves 1–3.5 cm. broad.
  - Stem villous or copiously pilose; leaves pubescent beneath, at least on the veins, with spreading or spreading-ascending hairs; terminal leaflet of primary leaves 2–6 cm. long, 1.5–4 cm. broad.......................Var. *typica.*
  - Stem densely short-pubescent; leaves grayish, silvery beneath and sometimes above with minute sericeous puberulence; terminal leaflet of primary leaves 1–2.7 cm. long, 1–2 cm. broad; southeastern.........Var. *appressipilis.*
- *b.* Leaflets narrowly oblong to linear, 6–10 mm. broad; southern.
  - Leaflets oblong, the larger 2–3 cm. long and 7–10 mm. broad; calyx 6–8 mm. long.......................Var. *longifolia.*
  - Leaflets narrowly linear, the larger 3–7 cm. long and 6–8 mm. broad; calyx 8–10 mm. long...........Var. *intercursa.*

Photo. W. H. Hodge.

Lespedeza hirta, var. typica: fig. 1, summit of flowering stem, × 1; fig. 2, summit of petiolule of terminal leaflet, × 10; fig. 3, portion of flowering raceme, × 4; figs. 4 and 5, portions of fruiting racemes, × 4.

Photo. W. H. Hodge.

Lespedeza hirta, var. appressipilis: fig. 1, summit of fruiting plant (isotype), × 1; fig. 2, median cauline leaves and (at right) flowering raceme, × 1; fig. 3, portion of fruiting raceme, × 4; fig. 4, lower surface of leaf, × 10; fig. 5, summit of petiolule of terminal leaflet, × 10.

a. Peduncles mostly shorter than their subtending leaves, producing a virgate leafy inflorescence; racemes relatively compact in fruit, only 1–2.5 cm. long; leaflets oblong, velutinous or sericeous, the larger ones 3–6 cm. long and 1–2 cm. broad; northern............Var. *dissimulans.*

L. HIRTA (L.) Horneman., var. TYPICA Schindler in Engler, Jahrb. xlix. 623 (1913). *Hedysarum hirtum* L. Sp. Pl. 748 (1753). *L. polystachya* Michx. Fl. Bor.-Am. ii. 71, t. 40 (1803). *L. hirta* (L.) Hornem. Hort. Reg. Bot. ii. 699 (1815). *L. hirta,* var. *sparsiflora* Torr. & Gray, Fl. N. Am. i. 368 (1840).—Dry soils, southwestern Maine to southern Ontario, south to Georgia (Florida?), Alabama, Arkansas and eastern Texas. The following, selected from ten times as many specimens, are characteristic. MAINE: Alfred, July 23, 1936, *Knowlton;* South Berwick, September 11, 1896, *Parlin.* NEW HAMPSHIRE: Lee, Strafford Co., *Hodgdon,* no. 660; Hooksett, Merrimack Co., July 26, 1921, *C. F. Batchelder;* Hollis, Hillsboro Co., July 30, 1896, *Grout.* VERMONT: Vernon, August, 1895, *Grout;* Castleton, September 12, 1897, *Eggleston.* MASSACHUSETTS: Andover, *Pease,* no. 1516; Ayer, *Pease,* no. 23,990; Winchester, September, 1884, *Mrs. P. D. Richards;* West Roxbury, August and September, 1911, *F. F. Forbes;* Plymouth, *Fernald, Hunnewell & Long,* no. 9735; Falmouth, *Fogg,* no. 2449; Yarmouth, *Fernald & Long,* no. 9741; West Tisbury, *F. C. Seymour,* no. 1426; Nantucket, August, 1901, *Dame;* Douglas, *Weatherby et al.,* no. 3009; Sunderland, *F. C. Seymour,* no. 3733; Deerfield, *Day,* no. 97; Great Barrington, August 3, 1911, *Hoffmann.* RHODE ISLAND: Cumberland, September 13, 1903, *Williams;* Tiverton, *E. A. Mearns,* no. 187; South Kingston, *Collins & Fernald,* no. 11,360. CONNECTICUT: Franklin, August 22, 1914, *Woodward;* Southington, *Bissell,* no. 166; Waterbury, *Blewitt,* no. 768; Lyme, *Graves,* no. 305; Washington, September 1, 1919, *A. W. Evans;* Huntington, August 12, 1902, *Eames.* NEW YORK: north of Patten's Mills, Washington Co., August 9, 1896, *Burnham;* Bethlehem, Albany Co., *House,* no. 10,799; Black Rock Forest, Orange Co., *Raup,* no. 7856; Southampton, Suffolk Co., *St. John,* no. 2771; Sandy Ridge, northeast of Phoenix, Oswego Co., *Fernald, Wiegand & Eames,* no. 14,361; Ithaca, *Eames,* no. 6741. NEW JERSEY: Manchester, 1854, *Hexamer & Maier;* Atsiom, August 10, 1926, *Benner, Long & Bassett;* Cold Spring, Cape May Co., *Gershoy,* no. 381. PENNSYLVANIA: Wayne, Delaware Co., *E. B. Bartram,* no. 1161; near Rohrerstown, Lancaster Co., September 19, 1901, *Heller;* Franklin, Green Co., August 3, 1922, *S. S. Dicky;* Treichler, Lehigh Co., August 25, 1923, *Churchill.* DELAWARE: near Wilmington, *R. R. Tatnall,* no. 3509. MARYLAND: College Park, *C. P. Smith,* nos. 2609 and 2767; Clinton, September, 1921, *Holm.* WEST VIRGINIA: Roland Park, Cabell Co., *Gilbert,* no.

795; White Sulphur Springs, *Hunnewell*, no. 7092. VIRGINIA: below Aldie, Fauquier Co., *Allard*, no. 890; Elko Station, Henrico Co., *Fernald & Long*, no. 9352. NORTH CAROLINA: Swain Co., August 16, 1891, *Beardslee & Kofoid;* near Biltmore, *Biltmore Herb.*, no. 587[a]; Middlesex, Nash Co., *Godfrey & Kerr*, no. 6615; south of Aberdeen, Scotland Co., *Godfrey*, no. 6906. SOUTH CAROLINA: Pendleton, Anderson Co., *Wiegand & Manning*, no. 1603. ONTARIO: Queenstown Heights, *J. Macoun*, no. 474; London, *Burgess;* Leamington, *J. Macoun*, no. 34,273. OHIO: Newell Ledge, Portage Co., September 6, 1905, *R. J. Webb;* Cleveland, *Greenman*, no. 956; Friendship, Scioto Co., *Demaree*, no. 10,825. INDIANA: Bedford, *Kriebel* no. 2815; Mineral Springs, *Lansing*, no. 3356; Dune Park, *Greenman*, no. 2661. KENTUCKY: Kuttawa, Lyon Co., *Eggleston*, no. 5318; Pine Mt., Harlan Co., *Kearney*, no. 127. TENNESSEE: Cumberland Co., August 24, 1890, *Coffman;* east of Crossville, *Svenson*, no. 4195; southeast of Hollow Rock Junction, Carroll Co., *Svenson*, no. 454. ALABAMA: Auburn, September 8, 1897, *Earle & Tracy*. ILLINOIS: Cobden, *Earle*, no. 1500. MISSOURI: Green Co., 1880, *E. M. Shepard;* Swan, *Bush*, no. 3423. ARKANSAS: Booneville, Logan Co., *Demaree*, no. 8118; Hot Springs, *Scully*, no. 68; Murfreesboro, *Demaree*, no. 9404. OKLAHOMA: Page, Leflore Co., *G. W. Stevens*, no. 3413. TEXAS: near Texarkana, Bowie Co., *Heller & Heller*, no. 4202. PLATE 678.

Lespedeza hirta is usually stated to occur from New England to Minnesota, south to Florida, etc. In the representation which has accumulated in the Gray Herbarium I find no specimens which I can refer to var. *typica* from Michigan, Wisconsin and Minnesota. If it is in those states it must be local. Similarly, I find no material of var. *typica* from Florida, where var. *appressipilis* probably takes its place.

*Var. APPRESSIPILIS Blake in RHODORA, xxvi. 32 (1924).— Florida to eastern North Carolina and, in less extreme development, to southeastern Virginia. VIRGINIA: Cedarville, Norfolk Co., *Fernald & Griscom*, no. 2843; south of Sebrell, Southampton Co., *Fernald & Long*, no. 11,057; south of Skipper's, Greensville Co., *Fernald & Long*, no. 9587. NORTH CAROLINA: near Rocky Mount, Nash Co., *Godfrey*, no. 6988; near Goldsboro, Wayne Co., *Godfrey*, no. 6573; near Sanford, Lee Co., *Godfrey*, no. 6935; near Ft. Barnwell, Craven Co., *Godfrey & White*, no. 6831; near Grantsboro, Pamlico Co., *Godfrey & White*, no. 6809. SOUTH CAROLINA: 5 miles south of Georgetown, *Godfrey*, no. 8126. GEORGIA: east of Eastman, Dodge Co., *Harper*, no. 1978. FLORIDA: specimens cited by Blake, l. c. PLATE 679.

*Var. **longifolia** (DC.), comb. nov. *L. longifolia* DC. Prodr. ii. 349 (1825). *L. capitata* var. *longifolia* (Michx.) Torr. & Gray, Fl. N. Am. i. 368 (1840). *L. hirta* var. *oblongifolia* Britton in Trans. N. Y. Acad. Sci. xii. 66 (1893). *L. oblongifolia* (Britton) Stone, Pl. So. N. J. 509 (1912).—Local, on Coastal Plain, southern New Jersey to Louisiana. New Jersey: besides the original material cited by Britton and another collection cited by Stone there is a Torrey & Gray sheet without stated locality. Virginia: open pineland near Mason's Siding, about 1 mile north of Henry, Sussex County, *Fernald & Long*, no. 13,654. North Carolina: pineland near Goldsboro, Wayne Co., *Godfrey*, no. 6565. Florida: dry barrens near Jacksonville, *A. H. Curtiss* (without no.). Louisiana: without locality, *Drummond*. Plate 680. See discussion on p. 575.

*Var. **intercursa,** var. nov. (tab. 681, fig. 1–4), caulibus ad 1.5 m. altis cinereo-velutinis; foliis breviter petiolatis; foliolis linearibus obtusis subtus albido-sericeis, supra viridibus, longioribus 3–7 cm. longis 6–8 mm. latis; racemis ad 3 cm. longis; calycibus 8–10 mm. longis.—Virginia: roadside, Pleasant Ridge, Princess Anne County, September 9, 1935, *Fernald, Long & Fogg*, no. 4908; clearing in wet woods near Great Bridge, Norfolk County, August 4 and 5, 1934, *Fernald & Long*, no. 3974; argillaceous and siliceous swales and swaley thickets south of Zuni, Isle of Wight County, August 20 and 22, 1936, *Fernald, Griscom & Long*, no. 6622 (type in Herb. Gray); swaley clearing north of Emporia, August 19, 1936, *Fernald, Griscom & Long*, no. 6617 (most slender extreme); sphagnous bog about 1 mile northwest of Dahlia, Greensville County, August 20, 1938, *Fernald & Long*, no. 9076 (as *L. angustifolia*); all, unless noted, distributed as *L. capitata* var. *longifolia*. See discussion on p. 581.

Var. **dissimulans,** var. nov. (tab. 682), caulibus ad 1.3 m. altis velutinis; foliolis oblongis velutinis vel velutino-sericeis, longioribus 3–6 cm. longis 1–2 cm. latis; inflorescentiis elongatis virgatis valde foliosis; pedunculis perbrevibus 0.5–1 (rarissime –3) cm. longis arcte adscendentibus; racemis compactis 1–2.5 cm. longis; calycibus 6–8 mm. longis; siliquis plus minusve exsertis.—Northern and western New England, south to southeastern Massachusetts; Wisconsin. The following are characteristic. Maine: sunny gravelly bank, Orono, August 19, 1897, *Fernald;* dry thickets on clay terraces of Penobscot River, Veazie, September 6, 1916, *Fernald & Long*, no. 13,966 (type in Herb. New England Bot. Club); roadside, Chesterville, August 16, 1902, *L. O. Eaton.* New Hampshire: dry open ground, Walpole, August 21, 1916, *C. F. Batchelder.* Massachusetts: Groveland, Essex County, *C. N. S. Horner;* moors, Nantucket, August 18, 1917, *Churchill;* Stockbridge, August 12, 1904, *Hoffmann;*

dry sandy ground, Sheffield, August 13, 1920, *Churchill.* Wisconsin: sand-bank, Shawano, August 24, 1934, *Wadmond & Fassett,* no. 17,199; Fayette, Lafayette Co., August 22, 1889, *L. S. Cheney.*

A very puzzling plant, discussed on p. 582. Other New England specimens, collected very young and others from Wisconsin may belong here. Fully mature material is needed before the plant can be finally evaluated. The TYPE is the only collection seen with good fruit.

Plate 673 shows details of Lespedeza capitata var. typica (var. *sericea* Hook. & Arn.): fig. 1, summit of fruiting stem, × 1, from Perdido, Alabama, *Blanton,* no. 7082; fig. 2, fruiting head, × 4, from no. 7082; fig. 3, legumes, × 4, from base of fruiting calyx of no. 7082; figs. 4 and 5, upper and lower surfaces of leaf, × 10, from no. 7082.

Plate 674 shows L. capitata var. vulgaris Torr. & Gray: fig. 1, summit of flowering stem, × 1, from Limington, Maine, *Fernald, Long & Norton,* no. 13,964; fig. 2, portion of flowering head, × 4, from no. 13,964; fig. 3, portion of fruiting head, × 4, from Lexington, Massachusetts, November 13, 1892, *Deane;* figs. 4 and 5, lower and upper leaf-surfaces, × 10, from no. 13,964; fig. 6, legumes, × 4, from bases of calyx of fig. 3.

Plate 675 is of L. capitata var. calycina (Schindler) Fernald: fig. 1, summit of isotype, × 1; fig. 2, portion of fruiting spike, × 4, from isotype; fig. 3, lower leaf-surface, × 10, from isotype; fig. 4, median cauline leaves, × 1, from Louisiana, *Hale.*

Plate 676 is of L. capitata var. stenophylla Bissell & Fernald: fig. 1, summit of type, × 1; fig. 2, lower leaf-surface, × 10, from type; fig. 3, portion of flowering head, × 4, from White County, Indiana, *Heimlich,* no. 739; fig. 4, fruiting head, × 4, from Jasper County, Indiana, *Deam,* no. 51,267; fig. 5, legumes, × 4, from bases of calices of fig. 4.

Plate 677 shows L. capitata var. velutina (Bickn.) Fernald: fig. 1, flowering summit, × 1, from Little Neck, Long Island, July 31, 1853, *Hexamer & Maier;* fig. 2, median cauline leaves from same specimen; fig. 3, lower leaf-surface, × 10, from Groton, Connecticut, October 10, 1901, *Graves;* fig. 4, flowering head, × 4, from West Tisbury, Massachusetts, *Fernald & Fogg,* no. 935; fig. 5, portion of fruiting head, × 4, from Winchester, Massachusetts, October 20, 1901, *E. F. Williams;* fig. 6, legumes, × 4, from bases of calices of fig. 5.

Plate 678 shows L. hirta (L.) Hornem, var. typica: fig. 1, flowering top, × 1, from Southington, Connecticut, September 2, 1901, *Bissell;* fig. 2, summit of petiolule of terminal leaflet, × 10, from Winchester, Massachusetts, September, 1884, *Mrs. P. D. Richards;* fig. 3, portion of flowering raceme, × 4, from Clinton, Maryland, September, 1921, *Holm;* fig. 4, portion of a lax fruiting raceme, × 4, from Hammond Pond, Brookline, Massachusetts, September 22, 1886, Faxon; fig. 5, portion of compact fruiting raceme, × 4, from Nottingham, New Hampshire, 1896. *A. A. Eaton.*

Plate 679 is of L. hirta var. appressipilis Blake: figs. 1 and 2, summit and median foliage, × 1, from isotype; fig. 3, portion of fruiting raceme, × 4, from isotype; fig. 4, lower leaf-surface; from isotype; fig. 5, summit of petiolule of terminal leaflet, × 10, from isotype.

Plate 680 shows L. hirta var. longifolia (DC.) Fernald: fig. 1, flowering top, × 1, from Louisiana, *Drummond;* fig. 2, flowering raceme, × 4, from Goldsboro, Wayne County, North Carolina, *Godfrey,* no. 6565; fig. 3, petiolule of terminal leaflet, × 10, from the *Hale* specimen.

Photo. W. H. Hodge.

Lespedeza hirta, var. longifolia: fig. 1, summit of flowering plant, × 1; fig. 2, small flowering raceme, × 4; fig. 3, summit of petiolule of terminal leaflet, × 10.

Photo. W. H. Hodge.

Lespedeza hirta, var. intercursa: figs. 1 and 2, portions of type. × 1; fig. 3, summit of petiolule of terminal leaflet, × 10; fig. 4, portion of flowering raceme, × 1.

L. angustifolia: fig. 5, portion of fruiting raceme, × 4; fig. 6, summit of petiolule of terminal leaflet, × 10.

PLATE 681, FIGS. 1–4, shows L. HIRTA var. INTERCURSA Fernald: FIGS. 1 and 2, portions of TYPE, × 1; FIG. 3, summit of petiolule of terminal leaflet, × 10, from TYPE; FIG. 4, portion of flowering raceme, × 4, from TYPE. FIGS. 5 and 6, details of L. ANGUSTIFOLIA (Pursh) Ell. (as here interpreted): FIG. 5, portion of fruiting raceme, × 4, from Plymouth, Massachusetts, *Fernald & Svenson* in Pl. Exsicc. Gray, no. 463; FIG. 6, summit of petiolule of terminal leaflet, × 10, from Egg Harbor, New Jersey, September 3, 1891, *J. B. Brinton.*

PLATE 682 is of L. HIRTA var. DISSIMULANS Fernald: FIG. 1, summit of TYPE, × 1; FIG. 2, flowering raceme, × 4, from Chesterville, Maine, August 16, 1902, *L. O. Eaton;* FIG. 3, fruiting raceme, × 4, from TYPE; FIGS. 4 and 5, upper and lower leaf-surfaces, × 10, from TYPE.

ZORNIA BRACTEATA (Walt.) Gmel. To the very few known stations in Virginia add one in HENRICO COUNTY: railroad ballast, Atlantic Coast Line Railroad freight-yard, Richmond, no. 12,381. See p. 516.

*VICIA GRANDIFLORA Scop. NORTHAMPTON COUNTY: side of road to Savage Neck, 1 mile east of Eastville, *R. R. Tatnall,* no. 3381. GREENSVILLE COUNTY: near foot-path on rich deciduous wooded slope by Three Creek, slightly above the "fall-line", northwest of Emporia, no. 11,863.

A handsome European species. See p. 490.

*CENTROSEMA VIRGINIANUM (L.) Benth., var. **ellipticum** (DC.) comb. nov. *Clitoria virginiana, β. elliptica* DC. Prodr. ii. 234 (1825), as to diagnosis. SUSSEX COUNTY: dry white sand of woods and clearings near Chub, nos. 12,690 and 13,368. JAMES CITY COUNTY: sandy border of field south of Norge, no. 13,369. First from north of South Carolina. See p. 519.

Centrosema virginianum consists, in the United States, of three varieties. The typical plant, described by Linnaeus from Virginia, has the principal well developed leaves with narrowly to broadly ovate leaflets tapering gradually to a subacuminate apex. This occurs from the West Indies and Florida to Texas and eastern Mexico, northward to southern New Jersey, Tennessee and Arkansas. It is the common plant of eastern Virginia. Var. *ellipticum* has most or all of the well developed leaves with elliptic-oblong to oblong-ovate and blunt or gradually round-tipped leaflets. DeCandolle's original diagnosis of *Clitoria virginiana,* var. *elliptica* was clear: "foliolis ovato-oblongis aut ellipticis", as contrasted with his γ. *ovata* (typical *C. virginiana*) "foliolis ovatis". Under his var. *elliptica* DeCandolle cited plate 76 of Dillenius. That, however, seems to me referable to typical *Centrosema virginianum* and not to agree with DeCandolle's diagnosis. Var. *ellipticum* is relatively

rare. We have it from northern Florida to Louisiana, north to southeastern Virginia and Wayne Co., Kentucky (*Smith & Hodgdon*, no. 3878). Extremes with narrowest leaflets grade into the more southern *Centrosema virginianum*, var. *angustifolium* (DC.) Griseb. Fl. Brit. W. Ind. 193 (1860) = *Clitoria virginiana* α. *angustifolia* DC. l. c. (1825), with linear leaflets. Var. *angustifolium* occurs from the West Indies and Florida to eastern Texas and into Mexico. I have seen no material from north of Florida and Texas; and, whereas the common Virginian plant has leaflets mostly ovate, Small, thinking of the Florida plants, describes *Bradburya virginiana* (L.) Kuntze (*Centrosema virginianum*) with "Leaflets . . . linear, often narrowly so and elongate, to ovate", with primary emphasis on "linear". In the region where Clayton collected the type no plants with linear leaflets have been found.

ZANTHOXYLUM CLAVA-HERCULIS L. Range extended inland from the outer coast to ISLE OF WIGHT COUNTY: thicket back of sand-beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,696, abundant. See p. 523.

*CROTON MONANTHOGYNUS Michx. SOUTHAMPTON COUNTY: waste ground, Franklin, no. 12,396.

Extension north from North Carolina. See p. 514.

STILLINGIA SYLVATICA L. Range extended northward. SUSSEX COUNTY: dry open sandy woods and thickets near Chub, nos. 12,125 and 12,397. See p. 498.

EUPHORBIA POLYGONIFOLIA L. Range extended up the James to SURRY COUNTY: sand-beach of Cobham Bay, James River, northwest of Chippokes, no. 12,702.

E. AMMANNIOIDES HBK. To the first station north of Florida recorded in RHODORA, xli. 548 (1939) add the following. YORK COUNTY: sandy beach of York River above Yorktown, no. 12,703. SURRY COUNTY: inner border of sand-beach of Cobham Bay, James River, northwest of Chippokes, no. 12,705. ISLE OF WIGHT COUNTY: inner border of sandy beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,706; similar habitat, Ragged Island, northeast of Carrollton, no. 12,704. See pp. 517, 518, 522 and 523, and Wheeler in RHODORA, xliii. 128, map 39 (1941).

*E. HUMISTRATA Engelm. HENRICO COUNTY: railroad-ballast, Richmond, Fredericksburg and Potomac Railroad, Richmond, no. 12,708; similar habitat, South Richmond, no. 12,709. See p. 515 and Wheeler in RHODORA, ibid, 261 and map 40 (1941).

Adventive from west of the Appalachians.

Photo. W. H. Hodge.

Lespedeza hirta, var. dissimulans: fig. 1, summit of type, × 1; fig. 2, flowering raceme, × 4; fig. 3, fruiting raceme, × 4; figs. 4 and 5, upper and lower surfaces of leaf, × 10.

Photo. W. H. Hodge.

RHUS RADICANS: FIG. 1, portion of TYPE. × 1, from Linnean Herbarium.
R. RADICANS, var. RYDBERGII: specimen of Hortus Cliffortianus, referred by Linnaeus to *R. radicans*.

*E. MARGINATA Pursh. SOUTHAMPTON COUNTY: waste ground, Franklin, no. 12,395. ISLE OF WIGHT COUNTY: waste ground, Lee's Mill, no. 12,394. See p. 514.

E. DENTATA Michx. To the few recorded stations add from HENRICO COUNTY: waste places and railroad ballast, Richmond, nos. 12,313, 12,712 and 12,713; leaves varying from narrowly lanceolate to elliptic-ovate.

CALLITRICHE DEFLEXA A. Br., var. AUSTINI (Engelm.) Hegelm. To the few recorded stations add one in SUSSEX COUNTY: argillaceous fallow field south of Stony Creek, no. 11,869. See p. 491.

Those who take up for this barely separable variety of the South American *Callitriche deflexa* the name *C. terrestris* Raf. have evidently overlooked the statements of Hegelmaier. In his Monographie der Gattung Callitriche, 55 (1864) Hegelmaier stated that *C. terrestris* Raf. was the terrestrial state of *C. verna*. Later, in his critical paper, *Zur Systematick von Callitriche* in Verhandl. d. Bot. Vereins f. Brand. ix. 16 (1867), Hegelmaier definitely said: "Was in den Herbarien unter dem Namen *C. terrestris* Raf. liegt, sind Landformen verschiedener Species, namentlich auch von *C. verna* und *heterophylla*"; and he went on to state that DeCandolle had material from Rafinesque. Rafinesque's account was as follows:

> "1. Callitriche terrestre, terrestrial callitriche; stem procumbent spreading, leaves entire, thick, petiolated, oblong, obtuse flowers monoiceous; it is found in some moist grounds in New-Jersey and Pennsylvania".—Raf. in Med. Repos. hex. 2, v. 358 (1808).

It might easily be the terrestrial state of one of the amphibious species and in view of Hegelmaier's comments the name can hardly be maintained for *C. deflexa*, var. *Austini*.

SOME VARIETIES AND FORMS OF RHUS RADICANS AND R. TOXICODENDRON (PLATES 683–685).—It is now quite clear that the specimen in the Linnean Herbarium which was the primary basis of *Rhus Toxicodendron* is the low and simple to only sparsely branching, erect and slender plant, with obtuse and strongly pubescent leaflets, characteristic of the Coastal Plain from New Jersey to Texas and called by Michaux *R. Toxicodendron*, var. *quercifolia;* and that the often coarser species with usually more bushy to high-climbing habit and with acuminate leaflets and less pubescence is *R. radicans* L. Photographs of the two types in the Linnean Herbarium make this clear. Within these two

major species Greene, Nieuwland and some others have proposed more than thirty of their species; though Barkley,[1] following them in treating *Rhus,* § *Toxicodendron* (Mill.) Gray as a genus *Toxicodendron,* recognizes only one departure from type in the two species in eastern North America. For many years, puzzled by the great variation of these species in eastern Virginia, Mr. Long and I have been accumulating material. This, with the large series already in the Gray Herbarium and in the herbarium of the New England Botanical Club, shows that each of the two primary species has well defined forms (some of them treated by others as species or varieties) and that in *R. radicans* we have within the Gray's Manual range three series which have sufficiently individual geographic ranges as to be apparently worthy recognition as geographic varieties. These eastern varieties and forms of *R. radicans* I distinguish as follows:

a. Stems strongly woody and prolonged, bushy and much-branched, erect, leaning, trailing or high-climbing and then forming aerial clinging roots; leaves alternately scattered along the branches; terminal leaflet narrowly to broadly ovate, scarcely rotund, gradually acuminate . . . *b.*
- *b.* Leaves firm to subcoriaceous, on petioles 2–10 (rarely –18) cm. long; leaflets mostly entire, the terminal one 3.5–10 (–14) cm. long; fruiting panicles dense, 1.5–5 (–7) cm. long; erect, leaning or climbing . . . *c.*
  - *c.* Fruit glabrous.
    - Leaves glabrous or pilose or hispid only along the midrib and bases of veins .... *R. radicans* (typical).
    - Leaves pilose on the lower surface ....Forma *hypomalaca.*
  - *c.* Fruit pubescent; leaves as in typical form. Forma *malacotrichocarpa.*
- *b.* Leaves membranaceous, on petioles mostly 0.65–2 dm. long; leaflets coarsely dentate or lobate, undulate or entire, the terminal one 1.1–2 dm. long; fruiting panicle more open, 3.5–8 cm. long; high-climbing . . . *d.*
  - *d.* Lower leaf-surfaces and petioles glabrous ....Var. *vulgaris.*
  - *d.* Lower leaf-surfaces soft-pubescent.
    - Petioles glabrous ....Forma *intercursa.*
    - Petioles villous-tomentose ....Forma *Negundo.*

a. Stems woody for only 0.5–6 dm. above creeping subterranean stoloniferous bases, simple or very sparsely upright-branched, with no aerial roots; leaves approximate at summit of stem and branches, thus appearing falsely verticillate, on erect petioles 0.5–2.3 dm. long; leaflets membranaceous or subcoriaceous (in exposed habitats), dentate, undulate or entire, the terminal one broadly ovate to suborbicular (rarely narrower) and abruptly acuminate, 0.4–1.5 dm. long, the veins and veinlets of the lower surface often hirtellous ....Var. *Rydbergii.*

[1] Barkley in Ann. Mo. Bot. Gard. xxiv. 417–441 (1937).

R. RADICANS L. Sp. Pl. i. 266 (1753), photograph of TYPE in Gray Herb., our PLATE 683, FIG. 1. *R. Toxicodendron*, var. γ. *microcarpa* Michx. Fl. Bor.-Am. i. 163 (1803), photograph in Gray Herb.[1] *R. radicans*, var. *microcarpa* (Michx.) DC. Prodr. ii. 69 (1825). *Toxicodendron radicans* (L.) Ktze. Revis. Gen. i. 153 (1891). *R. Toxicodendron*, var. *radicans* (L.) Dippel, Handb. Laubholzk. ii. 376 (1892). *R. Blodgettii* Kearney in Bull. Torr. Bot. Cl. xxi. 486 (1894). *T. Blodgettii* (Kearney) Greene, Leafl. i. 126 (1905). *R. Toxicodendron*, forma *radicans* (L.) McNair in Field Mus. Bot. Ser. iv. 68 (1925). *T. radicans*, var. *microcarpum* (Michx.) Farwell in Am. Midl. Nat. xii. 125 (1930).—Thickets, open woods, sandy or rocky places and fencerows, southern Quebec to Minnesota, south to Nova Scotia, New England, Long Island, Florida, Kentucky and Illinois. Among many specimens examined, the following are characteristic. QUEBEC: Ste.-Geneviève, Ile de Montréal, *Adrien*, no. 1439. NOVA SCOTIA: East Jordan, Shelburne Co., *Fernald & Long*, no. 24,095; Yarmouth, *Pease & Long*, no. 21,785; Vaughan (Tusket) Lake, Gavelton, Yarmouth Co., *Fernald & Long*, no. 24,048. MAINE: Northfield, Aug. 15, 1931, *Knowlton;* Rockland, *Fernald*, no. 1994; Bowdoinham, *Fassett*, no. 352. NEW HAMPSHIRE: Gorham, *Pease*, no. 10,711; Plymouth, *Fernald*, no. 11,800. MASSACHUSETTS: Hyannis, Barnstable, *Fernald, Butters & St. John*, no. 15,269; Brewster, *Fernald & Long*, no. 17,053; Harwich, *Fernald & Long*, no. 17,055. RHODE ISLAND: Warren, *Sanford*, no. 10,121; Wickford, June 18, 1908, *E. F. Williams*. CONNECTICUT: Bethlehem, *Weatherby*, no. 4956; Oxford, June 8, 1889 and July 24, 1896, *Harger*. NEW YORK: Montezuma, Cayuga Co., *Eames, Wiegand & Randolph*, no. 12,399; Greenport, Long Island, August 22, 1858, *E. S. Hoar*. NEW JERSEY: New Brunswick, *F. L. Stevens* in Halsted's Am. Weeds, no. 119; east of Cedar Grove, Ocean Co., *Fogg*, no. 4832. PENNSYLVANIA: West Philadelphia, *J. W. Adams*, no. 619.

[1] I am purposely refraining from guesses as to the identities of the species of Miller in his Gardeners Dictionary, ed. 8 (1768). Many authors, including Barkley, have assumed, apparently without studying Miller's types (if they exist), that his *Toxicodendron vulgare, pubescens, glabrum* and *volubile* are all referable to typical *Rhus radicans* L. The latter, as shown by a photograph of the type (our PLATE 683, FIG. 1) is the shrub with relatively small, firm and entire ovate to ovate-lanceolate leaflets with rounded bases, the petioles rarely 1 dm. long. *T. vulgare*, as described by Miller, had "foliolis obcordatis, glabris, integerrimis . . . The foot-stalks of the leaves . . . near a foot long" and he cited as the only synonym of this shrub with glabrous and entire leaflets the *Toxicodendron triphyllum, folio sinuato pubescente* of Tournefort. Similarly, under his *T. pubescens*, "foliolis ovatis inciso-angulatis pubescentibus", Miller gave as the only synonym *T. triphyllum, glabrum* of Tournefort. In the modern slang, Miller's diagnoses and synonymy were a "mess." Without clarification of his names by means of accurate photographs they cannot safely be interpreted. For similar reasons I am omitting several additional names, listed by others without question. In so plastic a group their identity, merely from the vague descriptions, can only be assumed.

Delaware: south of New Castle, *Tidestrom*, no. 11,547; east of Leipsic, Kent Co., *E. L. Larsen*, no. 714. West Virginia: Hendricks, Tucker Co., *A. H. Moore*, no. 2115. Virginia: False Cape, *Fernald & Long*, no. 4016; Bedford Co., June and Sept., 1871, *A. H. Curtiss*. South Carolina: type of *R. Toxicodendron*, var. γ *microcarpa* Michx. (photo. in Gray Herb.). Florida: Alva, Lee Co., *Hitchcock*, no. 39; Sykes Hammock, Dade Co., *Small & Mosier*, no. 5482; Manatee, June, 1845, *Rugel;* Pine Key, *Blodgett* (tracing of type of *R. Blodgettii*). Wisconsin: Milwaukee Co., 1907, *Howland Russell*. Illinois: Ottawa, *J. W. Huett*. Minnesota: near Houston, Houston Co., *Butters & Rosendahl*, no. 3614.

When he published *Rhus Blodgettii* Kearney took as *R. radicans* the southern shrub with large, membranaceous and pubescent leaves which I am treating as a form under var. *vulgaris*. Kearney, with this interpretation of *R. radicans,* said that *R. Blodgettii* "may easily be distinguished by the smaller . . . thick and coriaceous leaflets, the upper surface shining and perfectly smooth, the lower surface pubescent only in the axils of the veins and at the base of the midrib", while his "*R. radicans* has the upper surface of the leaf almost always pubescent at least on the midrib, the lower surface pubescent all over."

*Forma **hypomalaca,** f. nov., foliorum paginis infernis pilosis. New York: along south wall, Vaughns, north of Hudson Falls, Washington Co., August 22, 1912, *S. H. Burnham;* on fence, 2 miles east of Vaughns, September 23, 1897, *Burnham*. West Virginia: dry upland woods, Berea, Ritchie Co., August 23, 1922, *L. F. & F. R. Randolph*, no. 1385 (type in Herb. Gray). Virginia: woods and thickets at base of calcareous bluffs along James River, above Chippokes, June 10, 1941, *Fernald & Long*, no. 13,064. Kentucky: Iroquois Park, May 16, 1932, *H. Bishop*, no. 56.

Forma **malacotrichocarpa** (A. H. Moore), comb. nov. *R. littoralis* Mearns in Proc. Biol. Soc. Wash. xv. 148 (1902), isotype in Gray Herb. *R. Toxicodendron*, forma *malacotrichocarpum* A. H. Moore in Rhodora, xi. 163 (1909), type in Gray Herb. *Toxicodendron radicans*, var. *littoralis* (Mearns) Barkley in Ann. Mo. Bot. Gard. xxiv. 434 (1937).—Scattered in the range of the glabrous-fruited plant, from Maine to Florida and Indiana.

Barkley, l. c., cites many specimens, to which many more might be added. He also includes in the synonymy *Toxicodendron aboriginum* Greene, Leafl. i. 125 (1905), from Okla-

homa, which I have not seen. Greene's description calls for "thin" leaflets and "fruit . . . sparsely muriculate", whereas forma *malacotrichocarpa* has subcoriaceous leaves and distinctly pilose or villous fruit.

Var. VULGARIS (Michx.) DC. Prodr. ii. 69 (1825), at least as to basinym. *R. Toxicodendron*, var. α. *vulgare* Michx. Fl. Bor.-Am. i. 183 (1803), photograph of TYPE in Gray Herb.—Swampy woods and bottomlands, Florida to eastern Texas, north to southern Maine, Massachusetts, New York and Oklahoma. The following, selected from many specimens, are typical. MAINE: Fairfield, *Fernald & Long*, no. 14,017. MASSACHUSETTS: Andover, *Pease*, no. 836; Lexington, May 30, 1896, *Churchill;* New Marlboro, July 3, 1912, *Hoffmann.* RHODE ISLAND: Johnston, June 13, 1912, *Thos. Hope.* NEW YORK: Ithaca, *Wiegand*, no. 12,402. PENNSYLVANIA: Conewago, May 28, 1889, *Heller;* Northampton, August 21, 1923, *Churchill.* DELAWARE: west of Wilmington, *Tidestrom*, no. 11,500. MARYLAND: Horse Point, Tuckahoe River, *Tidestrom*, no. 11,977. SOUTH CAROLINA: northeast of Pineville, Berkeley Co., *Godfrey & Tryon*, no. 579; TYPE of variety, *Michaux* (photograph). FLORIDA: near Kissimmee, Osceola Co., *Hunnewell*, no. 8693. OKLAHOMA: Tishomingo, Johnston Co., *H. W. Houghton* in distrib. *G. W. Stevens*, no. 3559; Boss, McCurtain Co., *Houghton* in distrib. *Stevens*, no. 3718; Commerce, *Bush*, no. 10,142. TEXAS: Lake Como, Tarrant Co., *Ruth*, no. 941. PLATE 684.

It should be noted that in publishing *Rhus Toxicodendron*, var. *vulgaris* Michaux made no reference to the wholly dubious or confused *Toxicodendron vulgare* Mill. His var. *vulgaris* cannot, therefore, be held as a mere transfer of Miller's name. If it be urged that Michaux intended his var. *vulgaris* in the sense of typical *R. Toxicodendron*, it should be kept in mind that the specimen he described from South Carolina and Georgia is very different from the type of *R. Toxicodendron* L. I am, therefore, taking up Michaux's varietal name for the variation of *R. radicans* which he had.

*Forma **intercursa,** f. nov., var. vulgari similis, foliolis subtus velutino-pilosis, petiolis glabris.—PENNSYLVANIA: Neshaminy, Bucks Co., June 10, 1928, *Fred McDowell.* VIRGINIA: deciduous woods, Curles Neck Farm, Henrico Co., June 21, 1936, *Fernald, Long & Smart*, no. 5832 (TYPE in Herb. Gray); wooded bottomlands and swampy woods near Nottoway River, east of Stony Creek, Sussex Co., June 9, 1938, *Fernald & Long*, no. 8349.

*Forma **Negundo** (Greene), comb. nov. *Toxicodendron Negundo* Greene, Leafl. i. 117 (1905). *R. Toxicodendron Negundo* (Greene) F. C. Gates in Trans. Kans. Acad. Sci. xli. 106 (1938).—Distinguished by the large mostly membranaceous leaflets villous-tomentose beneath, the petioles also tomentose.—Wooded swamps and bottomlands, Florida to eastern Texas, north to Virginia, Ohio, Indiana, Illinois and Iowa. The following are characteristic. Virginia: Matoaka Park, James City Co., *Baldwin*, no. 362; seeping calcareous wooded bluffs by Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), Isle of Wight Co., *Fernald & Long*, no. 13,065; Claremont Wharf, Surry Co., *Fernald & Long*, no. 8350; Blacksburg, Montgomery Co., *Adams & Wherry*, no. 2230; Pembroke, Giles Co., *Fogg*, no. 14,773. North Carolina: Tryon, Polk Co., May 18, 1899, *Churchill.* Ohio: Yellow Springs, Greene Co., *Demaree*, no. 11,455. Indiana: Ingalls, Madison Co., *H. H. Smith*, no. 5619. Tennessee: Maryville, Blount Co., May 3, 1934, *R. K. Godfrey.* Illinois: Starved Rock, La Salle Co., *Greenman, Lansing & Dixon*, no. 66. Arkansas: Lake City, Craighead Co., *Demaree*, no. 7218; West Memphis, Crittenden Co., *Demaree*, no. 11,118; Natural Steps, Pulaski Co., *Demaree*, no. 8569; Norman, Montgomery Co., *Demaree*, no. 9563; War Eagle, Benton Co., *Demaree*, no. 6784. Louisiana: near Alexandria, *Ball*, no. 429. Kansas: Riley Co., *J. B. Norton*, no. 79, isotype of *Toxicodendron Negundo.* Texas: San Antonio, *Jermy*, no. 326.

*Var. Rydbergii (Small) Rehder in Journ. Arn. Arb. xx. 416 (1939). *R. Rydbergii* Small ex Rydb. Mem. N. Y. Bot. Gard. i. 268 (1900). *Toxicodendron Rydbergii* (Small) Greene, Leafl. i. 117 (1905). *T. macrocarpum* Greene, l. c. (1905). *T. coriaceum* Greene, ibid. 120 (1905). *T. pumilum* Greene, ibid. 124 (1905). *T. punctatum* Greene, ibid. 125 (1905). *R. Toxicodendron,* var. *Rydbergii* (Small) Garrett, Spring Fl. Wasatch Reg. ed. 3: 69 (1917).—Woods, rocky slopes and wet peat, Gaspé County, Quebec, to southern British Columbia, south to Nova Scotia, northern, central and western New England, mountains of western Virginia, northern Indiana, northern Illinois, western Kansas, Texas, New Mexico and Arizona. The following, selected from abundant specimens, are characteristic. Quebec: Cape Rosier, Gaspé Co., July 14, 1932, *Pease;* Milnikek, Matapedia R., *Rousseau*, no. 32,417; Montmorency Falls, *J. Macoun*, no. 66,814. New Brunswick: gorge of Aroostook River, Victoria Co., Aug. 17, 1901, *E. F. Williams;* Woodstock, *Fernald & Long*, no. 14,016. Nova Scotia: Port Bevis, Victoria Co., *Fernald & Long*, no. 21,792; Five-mile River, Hants Co., *Pease & Long*, no. 31,789; Bridgewater, *Fernald & Long*, no. 24,093. Maine: Fort Fairfield, *Fernald*, no. 1995; Winn, *Fernald & Long*,

Photo W. H. Hodge.

Rhus radicans, var. vulgaris: characteristic terminal leaflet. × 1.

Photo. W. H. Hodge.

RHUS TOXICODENDRON: FIGS. 1 and 2, TYPE, × 1, from Linnean Herbarium.
R. TOXICODENDRON, forma ELOBATA: FIG. 3, TYPE (including fruit), × 1.

no. 14,014; Pembroke, *Fernald*, no. 1993; Camden, *Rossbach*, no. 532. NEW HAMPSHIRE: Stark, *Pease*, no. 17,465; Randolph, *Pease*, no. 16,705; Shelburne, *Pease*, no. 12,249. VERMONT: Willoughby Lake, June 5, 1895, *Churchill;* Shelburne Point, June 25, 1913, *Knowlton;* Halifax, June 28, 1939, *Knowlton.* MASSACHUSETTS: Bradford, June 17, 1914, *Churchill;* Stony Brook Reservation, Suffolk Co., June 7, 1919, *Kidder.* NEW YORK: Trenton Falls, *Haberer*, no. 197; Selkirk, Oswego Co., *Fernald, Wiegand & Eames*, no. 14,374; Lansing, *Wiegand*, no. 12,401; Ithaca, *E. L. Palmer*, no. 768. VIRGINIA: north of Hopewell Gap, Bull Run Mts., Fauquier Co., *Allard*, no. 462; at 3600 ft. alt., near Luray, *Steele & Steele*, no. 151. ONTARIO: Stokes Bay, Bruce Peninsula, *Krotkov*, no. 9192. MICHIGAN: Charity Island, Saginaw Bay, Huron Co., September 25, 1911, *C. K. Dodge;* Agricultural College, June 9, 1894, *Skeels.* WISCONSIN: Minong, Washburn Co., *Fassett*, no. 8528; Milwaukee Co., 1907, *Howland Russell.* MINNESOTA: Spring Grove, *Rosendahl*, no. 280; Schoolcraft Island, Itasca Park, *M. L. Grant*, no. 2976. MANITOBA: Lake Winnipeg Valley, 1857, *Bourgeau.* NORTH DAKOTA: Devil's Lake, July 17, 1902, *Lunell.* SOUTH DAKOTA: Deadwood, *Rydberg*, no. 83. KANSAS: at 3500 ft. alt., Syracuse, Hamilton Co., *C. H. Thompson*, no. 102, isotype of *Toxicodendron macrocarpum* Greene. OKLAHOMA: Knowles, Beaver Co., *G. W. Stevens*, no. 516 (the specimen, showing the base broken off at ground-level, is less than 3 dm. high and characteristic var. *Rydbergii;* the memorandum on the label, "Climbing trees and shrubs", must have belonged to some other number). SASKATCHEWAN: without definite locality, 1857–8, *Bourgeau.* IDAHO: Lake Pend d'Oreille, *Sandberg, MacDougal & Heller*, no. 963. WYOMING: Hartville, *A. Nelson*, no. 557; Pole Creek, *A. Nelson*, no. 154; Sheridan, *Rollins*, no. 558. COLORADO: at 5000 ft., Poudre R., Larimer Co., *J. H. Cowen*, no. 126; Norwood Hill, San Miguel Co., *E. P. Walker*, no. 498. UTAH: Wahsatch Mts., *S. Watson*, no. 218; Farmington Cañon, alt. 4300–4500 ft., *Pammel & Blackwood*, no. 3630; Farmington, June 11, 1908, *Mrs. Joseph Clemens;* Jackson Draw, alt. 7000 ft., Uinta Basin, *E. H. Graham*, no. 8115. NEW MEXICO: Kingston, alt. 6600 ft., *O. B. Metcalfe*, no. 1088, isotype of *Toxicodendron punctatum* Greene; Mogollon Mts., at 7500 ft., *O. B. Metcalfe*, no. 339; Winsor's Ranch, alt. 8400 ft., Pecos River National Park, *Standley*, no. 4011. ARIZONA: vicinity of Flagstaff, alt. 7000 ft., *MacDougal*, no. 28, isotype of *Toxicodendron pumilum* Greene; Navaho Reservation, *C. T. Vorhies*, no. 62; Chaperon Canyon, Chiricahua Mts., alt. 7500 ft., *Blumer*, no. 1325. WASHINGTON: Spokane, *Suksdorf*, no. 264 (*Toxicodendron coriaceum* Greene), *Kreager*, no. 538; Waitsburg, *Horner*, no. R 113 B 129; Coulee City, Grant

Co., *Thompson*, no. 9115. Oregon: The Dalles, *Thos. Howell;* Pendleton, June, 1886, *Henderson.* Plate 683, fig. 2.

Var. *Rydbergii* is more distinct from typical *Rhus radicans* than the other varieties and forms here considered, but altogether too many specimens are found which cannot be clearly identified. They seem to be quite transitional. There is no question that it was included by Linnaeus in his *R. radicans.* Although the sheet which Linnaeus had in his own herbarium at the time of preparing Species Plantarum is *R. radicans,* as here interpreted (plate 683, fig. 1), the specimen in the Clifford herbarium (plate 683, fig. 2) cited by him (Hort. Cliff. 110) is characteristic *R. radicans,* var. *Rydbergii.* The variety, I am told by some who have watched it in the field, rather rarely fruits as compared with the frequent and abundant fruiting of typical *R. radicans.* This scarcity of fruiting may, perhaps, be correlated with the highly perfected vegetative reproduction by subterranean stolons. There is no satisfaction in trying to separate the firm-leaved plants of open and more xerophitic habitats from the thinner-leaved plants of mesophytic areas. Greene indulged freely in an attempt to set up as species such responses to aridity and moisture, but the most extraordinary of his propositions is his *Toxicodendron pumilum,* based upon specimens collected on June 2, with the shattered fruit of the preceding year persisting and the new leaves not yet expanded.[1]

[1] In ordering up the material in the Gray Herbarium I find it necessary to have satisfactory names for the following:

Rhus radicans, var. **laetevirens** (Greene), stat. nov. *Toxicodendron laetevirens, phaseoloides* and *Arizonicum* Greene, Leafl. i. 123 (1905).

Isotypes of all three are in the Gray Herbarium, all from the same phytogeographic area, and show no difference which I can detect. They have very pale and narrow leaflets as compared with the other varieties of *R. radicans.*

R. radicans, var. **verrucosa** (Scheele), comb. nov. *R. verrucosum* Scheele in Linnaea, xxi. 592 (1848). *Toxicodendron verrucosum* (Scheele) Greene, Leafl. i. 124 (1905). *T. radicans,* var. *verrucosa* (Scheele) Barkley in Ann. Mo. Bot. Gard. xxiv. 435 (1937).

R. radicans, var. **divaricata** (Greene), comb. nov. *Toxicodendron divaricatum* Greene, Leafl. i. 122 (1905). *R. divaricata* (Greene) McNair in Field Mus. Publ. Bot. iv. 69 (1925), not Eckl. & Zeyh. (1834). *R. Greenei* McNair, ibid. as Correction (1925). *T. radicans,* var. *divaricata* (Greene) Barkley in Ann. Mo. Bot. Gard. xxiv. 433 (1937).

R. radicans, var. **pubens** (Engelm. ex Wats.), comb. nov. *R. Toxicodendron,* var. foliis ramulisque molliter pubentibus. Thickets, New Braunfels [Texas], Engelm. ex Gray in Bost. Journ. Nat. Hist. vi. 295.—Pl. Lindh. pt. ii. 159 (1850). *R. Toxicodendr.,* var. *pubens* Engelm. ex Wats. Bibl. Index, 185 (1878), interpretable through reference to descr.

The sheet of the type or isotype in the Gray Herbarium has Lindheimer's label with the data: "247. High in thickets, not climbing, fl. odorous. New Braunfels, Texas.

True *Rhus Toxicodendron* is a relatively constant species. Although the name was early tossed about, the specimen in the Linnean Herbarium (our PLATE 685, FIGS. 1 and 2) which Linnaeus had in preparing Species Plantarum is quite definite. It was properly interpreted by many of the earlier authors (Nuttall, DeCandolle and others) and recently by Britton and by Rehder as the small nonclimbing shrub of the southeastern Coastal Plain which was called by Michaux *R. Toxicodendron,* var. *quercifolia.* Barkley has given the synonymy under *Toxicodendron quercifolium* [as *quercifolia*] (Michx.) Greene in Ann. Mo. Bot. Gard. xxiv. 420 (1937) and it need not here be repeated, except to exclude as altogether doubtful the *T. pubescens* Mill. and the resultant combination *R. pubescens* (Mill.) Engler. As to the specific name, it is somewhat singular that most, if not all, monographers cite the original binomial, *Rhus Toxicodendron,* without qualification as published by Linnaeus in Species Plantarum, ed. 1 (1753), except when, as in DeCandolle's Prodromus (ii. 69) and in Engler's treatment in DeCandolle's Monographiae, iv. 393 (1883), they start it from p. 381, which was in ed. 3 (1766) of Species Plantarum, where, as in his ed. 2 (1762), Linnaeus definitely called it *R. Toxicodendr*UM. Barkley (p. 426), to be sure, says "*R. Toxicodendrum* L., Sp. Pl. **1:** 266. 1753, in part; Torr. & Gray, Fl. N. Am. **1:** 218. 1838, as *R. Toxicodendron*", thus implying that, first, the name was spelled *Toxicodendrum* by Linnaeus in 1753 and, second, that the change to *Toxicodendron* started with Torrey & Gray in 1838. Since there is no justification for either of these inferences and since the citation in *Index Kewensis* is inadequate, it seems important to attempt a clarification of the name. As I see the facts they are embodied in the following paragraph.

RHUS TOXICODENDR L. Sp. Pl. i. 266 (1753). *R. Toxicod.* L. Syst. Nat. ed. 10, ii. 964 (1759). *R. Toxicodendron* L. Syst. Nat. ed. 11, ii. 964 (1760). *R. Toxicodendrum* L. Sp. Pl. ed. 2, i, 382 (1762) and ed. 3, i. 381 (1766). *R. Toxicodendr.* L. Syst. Nat. ed. 12, ii. 218 (1767) and ed. 13, ii. 218 (1770).

F. L. Aug. '46" and in Engelmann's hand "*Rhus Toxicodendron* ? var. *pubens*". The larger and flowering specimen has very pale bark, the young growth cinerous-puberulent, the panicle very long and lax, the firm leaflets densely velvety-puberulent. This I take as TYPE or ISOTYPE. With it is a small sterile sprig of var. *verrucosa.*

It is evident that Linnaeus and the space-regulations of his printers caused some doubt as to the ending of the name, a borrowing of the earlier generic name *Toxicodendron.* Fortunately, however, the first time the full spelling was used (unless, unhappily, I may have overlooked a case) for the species, in 1760, Linnaeus conformed to the long-established usage.

Typical *Rhus Toxicodendron* has lobulate or coarsely toothed leaves suggesting oak-leaves, whence the colloquial Poison Oak. They are crowded near the tip of the slender ascending stem and thus appear somewhat falsely verticillate. Their lower surfaces are velvety to the touch with dense pilosity, and the fruit is commonly very pubescent. The lobes or teeth vary from rounded to deltoid but there seems to be no clear character to separate such variations. In adding to the synonymy Greene published several names. One of his proposed species, *Toxicodendron compactum* Greene, Leafl. i. 126 (1905), of which an isotype is before me, had leaflets which "recall strongly those of some oaks of the black oak series; though the lobes are all obtuse." On the next page it was said of *T. quercifolium* (Michx.) Greene that "Its leaflets are patterned always after the black-oak type, i. e. are acutangular, while in . . . *T. compactum* they have sinuate and rounded lobes, imitating the white-oak type".

Scattered through the range there are colonies with more or less elliptic and almost entire to barely undulate leaflets. These are so definite that I am calling them

*R. Toxicodendron, forma **elobata,** f. nov. (tab. 685, fig. 3), foliolis ellipticis subintegris. New Jersey: 1½ miles southeast of Bridgeton, Cumberland County, July 20, 1909, *S. S. Van Pelt* (type in Herb. Gray.). Virginia: dry sandy woods south of Petersburg, June 8, 1938, *Fernald & Long,* no. 8346 (transitional); dry sandy pine and oak woods north of Orion, Greensville County, *Fernald & Long,* no. 13,675. Louisiana: without statement of locality, *Hale.*

Throughout its broad range, from New Jersey and Maryland to Texas, the fruit of *Rhus Toxicodendron* is usually quite pubescent. At one of our stations in Sussex County, Virginia, however, the fruit is essentially glabrous. This plant I am calling

*R. Toxicodendron, forma **leiocarpa,** f. nov., fructibus glabris vel glabratis.—Virginia: dry open sandy pine and oak thickets near the County Line, south of Jarratt, June 8, 1938, *Fernald & Long,* no. 8347 (type in Herb. Gray, isotype in Herb. Phil. Acad.).

In plate 683, fig. 1 is from the type of Rhus radicans L.; fig. 2, the Hortus Cliffortianus specimen included by Linnaeus with the other and here interpreted as R. radicans, var. Rydbergii (Small) Rehder.

Plate 684 shows a characteristic terminal leaflet, × 1, of Rhus radicans, var. vulgaris (Michx.) DC., from Tishomingo, Oklahoma, *H. W. Houghton* in distrib. *G. W. Stevens,* no. 3559 (quite like the type of *R. Toxicodendron,* var. *vulgare* Michx.—photograph too weak for reproduction).

In plate 685, figs. 1 and 2 are from the type of Rhus Toxicodendron L.; fig. 3 from type, × 1, of R. Toxicodendron, forma elobata Fernald.

The Variations of Rhus aromatica in the Gray's Manual Range (Plates 686 and 687).—

Rhus aromatica Ait., var. **arenaria** (Greene), comb. nov. *Schmaltzia arenaria* Greene, Leafl. i. 130 (1905). *R. trilobata,* var. *arenaria* (Greene) Barkley in Ann. Mo. Bot. Gard. xxiv. 408 (1937); *Schmaltzia trilobata,* var. *arenaria* (Greene) Barkley in Am. Midl. Nat. xxiv. 660 (1940).

The small-leaved extreme of *Rhus aromatica* which centers on the dunes at the head of Lake Michigan has the characteristic fruits and stones of *R. aromatica,* not those of *R. trilobata* Nutt. The latter, described from "the central chain of the Rocky Mountains" has, as originally described, "the nut flat". In his treatment of the group, originally in *Rhus,* when, under conservative influence, he followed the broad and mature judgment of DeCandolle, Torrey, Gray, Endlicher, Bentham & Hooker, Engler and many others (including even Rydberg and Small in their later years) in maintaining the subgenus within *Rhus,* and in his latest paper, preferring the procedure of Desvaux, Rafinesque and Greene in keeping it apart, Barkley places the small-leaved shrub of the dunes of Lake Michigan under *R. trilobata* or *Schmaltzia trilobata* because of its small leaves, with flabelliform terminal leaflet.

That the group is most complex every one knows; and Rafinesque, Greene and Rydberg proposed nearly half a hundred specific names for its variations in the United States alone. The shrub of "the central chain of the Rocky Mountains", from Alberta to New Mexico, described by Nuttall as *R. trilobata* (plate 686, figs. 1–5) has the fruit pruinose with waxy or glandular

atoms and without or with only remote nonglandular villi. The stone (figs. 4 and 5) is 4.5–6 mm. long and strongly flattened, the sides almost plane.

The more eastern *Rhus aromatica* Ait. (*R. canadensis* Marsh., not Mill.) has larger leaves than in *R. trilobata* and the fruit is very densely long-villous, so densely that the surface of the fruit is almost hidden (plate 687, fig. 9); and the relatively plump (though compressed) stones (figs. 10 and 11) have somewhat rounded to subumbonate sides and are 3.8–4.5 mm. long. It is, therefore, significant that the small-leaved shrub of the dunes of Lake Michigan described by Greene as a species, *Schmaltzia arenaria* (plate 686, figs. 6 and 8–10), and treated by Barkley as an isolated eastern variety of the western *Rhus* or *Schmaltzia trilobata,* should have the densely long-villous fruit (fig. 8) and the relatively plump and small stone (figs. 9 and 10) of the eastern *R. aromatica.* Although in his recent Flora of Indiana Deam follows Barkley, it is quite reassuring that, in his detailed account of the small-leaved shrub of the Indiana dunes in his earlier Shrubs of Indiana (1924), he should have said: "It appears to be a dwarf form [of *Rhus canadensis,* i. e. *R. aromatica*] with puberulent branchlets. All specimens from the dune area belong to this form, and specimens from Porter County were referred to this species by Nieuwland. A study of the branchlets of specimens from thirteen counties shows that those from the dune area of Lake Michigan, and from Clark and Harrison Counties are puberulent. The remainder are smooth or nearly so. It is believed that the smoothness or pubescence of the branchlets is a character not sufficient to divide the species, on account of the intergrading forms."[1]

Consideration of the lines, if there are any, between *Rhus aromatica* and *R. trilobata,* as the latter is reputed to occur in the Gray's Manual range, leads one to *Schmaltzia serotina* and *S. lasiocarpa* Greene. Their treatment by different authors is as follows:

Schmaltzia serotina Greene, Leafl. i. 131 (1905). *S. lasiocarpa* Greene, ibid. 141 (1905). *Rhus canadensis,* var. *serotina* (Greene) Palmer & Steyermark in Ann. Mo. Bot. Gard. xxii. 591 (1935). *R. trilobata,* var. *serotina* (Greene) Barkley in

[1] Deam, Shrubs of Indiana, 173 (1924).

Photo. W. H. Hodge.

Rhus trilobata: fig. 1, fruiting branch, × 1; fig. 2, portion of inflorescence, showing pubescent bracts, × 10; fig. 3, drupe, × 5; figs. 4 and 5, stone, × 5.
R. aromatica: fig. 7, portion of inflorescence, showing glabrous backs of bracts, × 10.
R. aromatica, var. arenaria: fig. 6, flowering branch, × 1; fig. 8, drupe, × 5; figs. 9 and 10, stone, × 5.

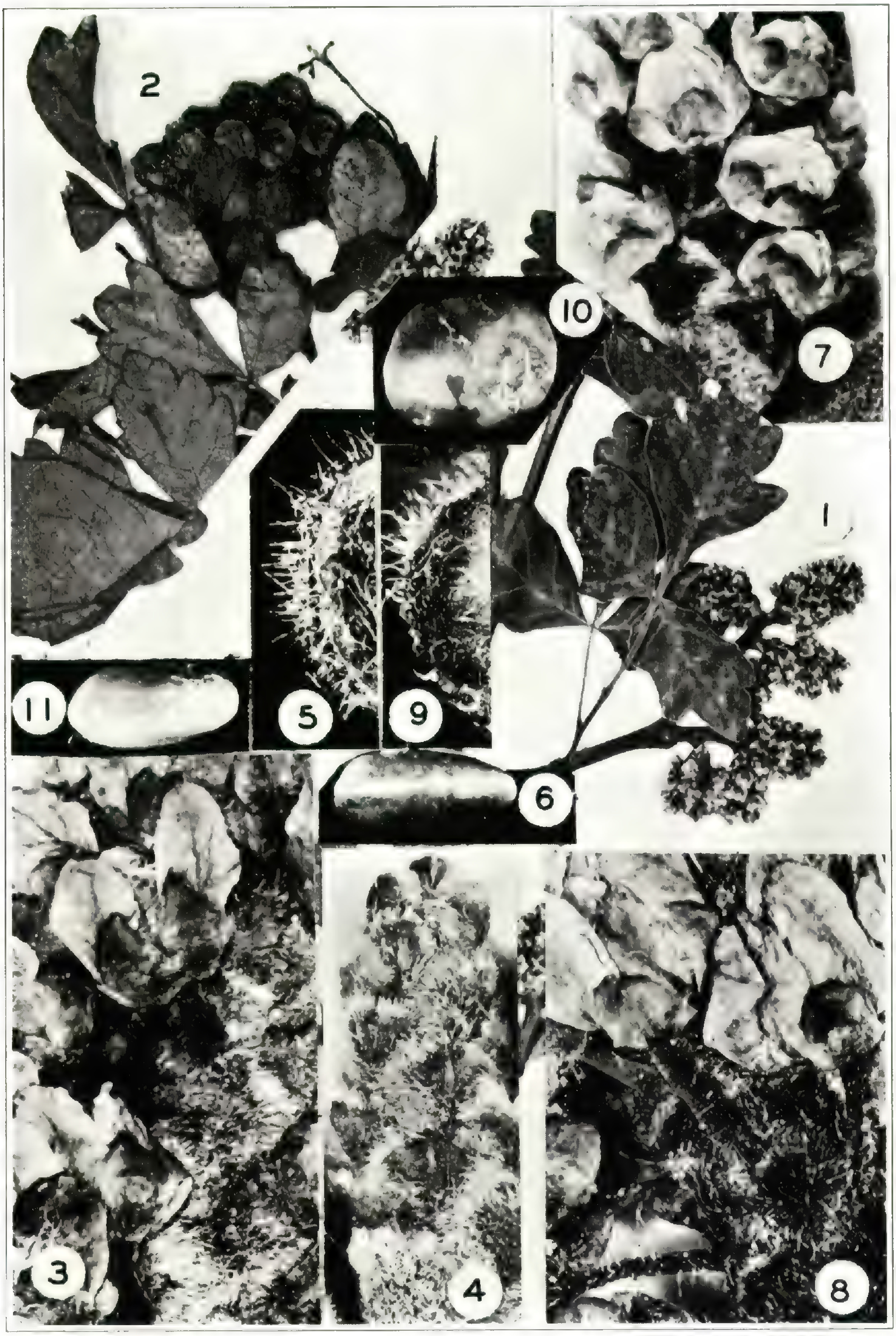

Photo. W. H. Hodge.

RHUS AROMATICA: FIGS. 7 and 8, portions of inflorescences, × 10; FIG. 9, portion of drupe, × 5; FIGS. 10 and 11, stone, × 5.

R. AROMATICA, var. SEROTINA: FIG. 1, flowering branch, × 1; FIG. 2, fruiting branch, × 1; FIG. 3, portion of inflorescence, × 10; FIG. 4, young ament, × 10; FIG. 5, portion of drupe, × 5; FIG. 6, stone, × 5.

Ann. Mo. Bot. Gard. xxiv. 406 (1937). *Rhus aromatica,* var. *serotina* (Greene) Rehder in Journ. Arn. Arb. xx. 415 (1939). *Schmaltzia trilobata,* var. *serotina* (Greene) Barkley in Am. Midl. Nat. xxiv. 661 (1940).

I have before me many of the numbers cited by Barkley, including nine sheets from the original collector of *Schmaltzia serotina* and an isotype of Greene's *S. lasiocarpa,* treated, correctly, by Barkley as inseparable from *S. serotina.* It is, then, important to note that these have heavily long-villous fruit (PLATE 687, FIGS. 2 and 5) as in *Rhus aromatica* and the relatively plump stone (FIG. 6) as in the eastern species. Their terminal leaflets were described by Barkley under *R. trilobata,* var. *serotina* as "4–9 cm. long, 5–8 cm. broad", and he considered them "a fairly uniform variety with fruit characters similar to the species, and with leaf characters between those of the species and *R. aromatica.*" The variety, as it occurs from Iowa and eastern Nebraska to Arkansas and eastern Oklahoma, is nearly uniform, but in the many sheets before me the terminal leaflets are only 2.5–6 cm. long and 2–4 cm. broad. Greene's original description of his *Schmaltzia serotina,* from Missouri, said "terminal leaflet 2 inches [5.7 cm.] long or more, 1½ [3.8 cm.] wide; his account of his *S. lasiocarpa,* from Kansas, said "terminal leaflet 1¼ to 1¾ inches [3.18–4.45 cm.] long". I am unable to reconcile Greene's original measurements or my own with those given by Barkley in his monograph. Neither do I find the "uniform variety with fruit-characters similar to the species [*R. trilobata*]", at least as shown by the series from Nuttall's type-area of *R. trilobata,* "the central chain of the Rocky Mountains"; for typical *R. trilobata,* as already noted, has pruinose and only sparsely if at all villous fruit and flattened stones, *R. aromatica,* var. *serotina* densely long-villous fruit and smaller and plumper stones.

Two other characters seem to me wholly to justify Palmer & Steyermark and Rehder in treating *Schmaltzia serotina* as a variety of *Rhus aromatica,* rather than of *R. trilobata.* These are the bracts of the ament, and the relatively short pedicels. In typical *R. trilobata* the loosening bracts (PLATE 686, FIG. 2) of the ament are densely villous over the back; in *R. aromatica* they (PLATE 686, FIG. 7 and PLATE 687, FIG. 7) have a nearly

or quite glabrous area within the densely ciliate margin. In *R. aromatica*, var. *serotina* the bracts (PLATE 687, FIG. 4) show the bare area as in true *R. aromatica*.

Barkley characterizes the eastern *Rhus aromatica*[1] as having "flowers almost sessile", while his description assigns *R. trilobata* "pedicels about 2.5 mm. long." PLATE 686, FIG. 7 and PLATE 687, FIG. 8 show portions of flowering aments, × 10, from Natural Bridge, Virginia, of typical *R. aromatica;* PLATE 687, FIG. 3, a similar portion, also × 10, of an ament from Greenwood, Missouri (cited by Barkley), of *R. aromatica,* var. *serotina.* That the flowers in PLATE 686, FIG. 7 and in PLATE 687, FIG. 8 are not "almost sessile" and that the pedicels in PLATE 687, FIG. 3 do not approach "2.5 mm." is sufficiently evident.

I am fortunate that all the variations of the *Schmaltzia*-series within the Gray's Manual range are so clearly referable to *Rhus aromatica,* for farther west the complex generally referred to *R. trilobata* or its varieties shows many unfortunate transitions. *R. canadensis,* var. *serotina,* with leaflets too large and fruit too densely villous for typical *R. trilobata,* passes insensibly, it would seem, into the very small-leaved but villous-fruited shrub of Kansas, Oklahoma and Texas which Greene called *Schmaltzia pulchella, S. quercifolia* and *S. tridophylloides,* all of which are unequivocally placed by Barkley under *R. trilobata* (typical) or one of its varieties. These seem to merge westward and northwestward into the shrub with sparsely villous to non-villous fruit; and the old-fashioned treatment of them all as geographic varieties of a single specific type may prove to be the sound one.

In PLATE 686 FIGS. 1–5 are of RHUS TRILOBATA Nutt.: FIG. 1, fruiting branch, × 1, from Leucite Hills, Wyoming, *Merrill & Wilcox,* no. 704; FIG. 2. portion of inflorescence showing pubescent backs of bracts, × 10, from Blue Grass Hills, Wyoming, *A. Nelson,* no. 322; FIG. 3, drupe, × 5, from Twin Falls and Shoshone Falls, Idaho, *Nelson & Macbride,* no. 1350; FIGS. 4 and 5, stone, × 5, from Howe's Gulch, Colorado, *Crandall,* no. 124. FIGS. 6, 8, 9 and 10, R. AROMATICA Ait., var. ARENARIA (Greene) Fernald:

[1] *Rhus aromatica* is cited by Barkley from but two stations in Canada: Ile Lemieux, which is in the lower Ottowa River, not far from Ottawa; and Shannonville, which is slightly north of the eastern end of Lake Ontario. Nevertheless, his map, with only two dots in Canada, indicates the species as growing from Nippissing District to Algoma, north of Lake Huron and 300–400 miles northwest of its cited Canadian stations. He also cites and maps it from the Arnold Arboretum in Boston, where, of course, it is cultivated. There is no evidence of it as a native of New England outside of western Vermont and southern Connecticut.

FIG. 6, flowering branch, × 1, from Pine, Indiana, *Lansing*, no. 2711; FIG. 8, drupe, × 5, from Port Chester, Indiana, July 19, 1920, *D. C. Peattie;* FIGS. 9 and 10, stone from same collection. FIG. 7, portion of inflorescence of R. AROMATICA Ait., to show glabrous-backed bracts and long pedicels, × 10, from Natural Bridge, Virginia, May 8, 1887, *Kennedy*.

In PLATE 687 FIGS. 1–6 are of RHUS AROMATICA Ait., var. SEROTINA (Greene) Rehder: FIG. 1, flowering branch, × 1, from Greenwood, Missouri, *Bush* no. 6676; FIG. 2, fruiting branch, × 1, from Louisa County, Iowa, June 26, 1909, *Shimek;* FIG. 3, portion of inflorescence, showing glabrate backs of bracts, × 10, from no. 6676; FIG. 4, young ament showing glabrous backs of bracts, × 10, from Vale, Missouri, *Bush* no. 4929; FIG. 5, portion of drupe, × 5, from *Shimek;* FIG. 6, stone, turned edge up, × 5, from *Shimek.* FIGS. 7–11, R. AROMATICA Ait.: FIG. 7, portion of expanding inflorescence, showing glabrous backs of bracts, × 10, from Guilford, Connecticut, May 1, 1905, *G. H. Bartlett;* FIG. 8, portion of expanded inflorescence, showing long pedicels, × 10, from Natural Bridge, Virginia, May 8, 1887, *Kennedy;* FIG. 9, portion of drupe, × 5, from Lansing, New York, *MacDaniels,* no. 4508; FIGS. 10 and 11, stone, × 5, from Middleburg, New York, *Svenson,* no. 7841.

CELASTRUS ORBICULATUS Thunb. To the station recorded in Caroline County add one in HENRICO COUNTY: thickets and borders of woods, Richmond, no. 12,717.

C. SCANDENS L. ISLE OF WIGHT COUNTY: thicket back of sand-beach of Burwell's Bay, James River, below Fort Boykin, no. 12,716. SURRY COUNTY: rich calcareous wooded ravines along James River, Claremont, no. 13,680 (plants weak and sterile). See p. 520.

Our first records from the Coastal Plain of Virginia.

STAPHYLEA TRIFOLIA L. To the few Coastal Plain stations recorded add one in DINWIDDIE COUNTY: wooded bottomland of Appomattox River below Petersburg, no. 12,127. See p. 492.

ACER FLORIDANUM (Chapm.) Pax. Local range extended northward and northeastward. YORK COUNTY: rich wooded ravine by York River, above Yorktown, no. 12,128. ISLE OF WIGHT COUNTY: rich calcareous wooded slopes by Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,718; wooded bluffs along James River below Fort Boykin, no. 13,070; seen in great abundance west of Fort Boykin. SUSSEX COUNTY: alluvial woods along Nottoway River at Readjuster Bridge, south of Peanut, no. 12,399. See pp. 505, 510 and 523.

*A. RUBRUM L., var. DRUMMONDI (Hook & Arn.) Sargent. SUSSEX COUNTY: dry white sand of woods and clearings near Chub, no. 12,720; swampy woods near Nottoway River, above Readjuster Bridge, south of Peanut, no. 13,072. SOUTHAMPTON COUNTY: dry woods and clearings south of Berlin, no. 7526. NANSEMOND COUNTY: open wet pineland southwest of Marsh Hill School, south of South Quay, no. 12,721.

Range extended north from South Carolina.

*Impatiens biflora Walt., forma Peasei A. H. Moore. King William County: fresh tidal marsh of Pamunkey River, Sweet Hall, no. 12,724.

*I. biflora, forma immaculata Weatherby. King and Queen County: fresh tidal marsh of Mattaponi River, Walkerton, no. 12,723.

*Parthenocissus incerta (Kern.) K. Fritsch, forma macrophylla (Lauche) Rehder. Dinwiddie County: waste place, Petersburg, no. 12,408; spread from cultivation.

Ampelopsis arborea (L.) Koehne. To the few recorded stations add the following. Princess Anne County: climbing high in trees, Cedar Island, no. 12,406. Isle of Wight County: waste ground near Lee's Mill, no. 12,407. See pp. 513 and 514.

*Vitis labruscana Bailey. Henrico County: waste places and railroad ballast, Richmond, no. 12,405; obviously from seed thrown from car-window.

V. aestivalis Michx., var. argentifolia (Munson) Fernald. Surry County: thicket back of sand-beach of Cobham Bay, James River, northwest of Chippokes, nos. 12,728 and 12,729. Isle of Wight County: similar habitat, Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,730.

The common northern and upland extreme with petioles and new branchlets glabrous. See p. 524.

V. cinerea Engelm. Local range extended northward to the James River. Isle of Wight County: thickets and borders of cypress and gum swamps back of beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,731; Bailey's Beach (MacKimmie's Wharf), near Rushmere, no. 12,734.

V. Baileyana Munson. Isle of Wight County: thicket back of sand-beach of Burwell's Bay, James River, at Bailey's Beach (MacKimmie's Wharf), near Rushmere, no. 12,732; border of cypress and gum swamp back of beach of Burwell's Bay, below Rushmere (Fergusson's Wharf), no. 12,733. See p. 524.

First record east of the upland of western Virginia.

*Tilia floridana (V. Engler) Small. Surry County: rich woods on fossiliferous sandy slopes of gullies near Claremont Wharf, no. 7897 (as *T. Michauxii* Nutt.).

Extension north from North Carolina.

Tilia, as it occurs along the lower James, is as baffling as elsewhere. I find myself incapable of applying with satisfaction the keys and descriptions of Sargent's revision of the American species in Bot. Gaz. lxvi. 421–438, 494–511 (1918). But, judging by specimens so identified, our no. 7897 seems to be *T. flori-*

Photo. W. H. Hodge.

KOSTELETZKYA VIRGINICA, var. TYPICA: FIG. 1, flowering branch, × 1; FIG. 2, fruit, × 3.
Var. AQUILONIA: FIG. 3, flowers, × 1, from TYPE; FIG. 4, fruit, × 3.
Var. ALTHEAEFOLIA: FIG. 5, fruit, × 3.

Photo. W. H. Hodge.

HELIANTHEMUM CAROLINIANUM (type-species of *Crocanthemum*): FIG. 1, flowering plant, × 1; FIG. 2, mature inflorescence, × 1; FIG. 3, ovary and SESSILE stigma, × 10.

H. GUTTATUM (*Tuberaria guttata*): FIG. 4, plant, × ½, after *Reiche* and *Janchen*.

H. GLOBULARIFOLIUM (*Tuberaria*): FIG. 5, ovary and stamens, × 5, after *Grosser*.

dana (V. Engler) Small, Fl. Se. U. S. 761 and 1335 (not "Ashe, Fl. Southern U. S.," as cited by Sargent).

Near the station for no. 7897 there are handsome trees with the leaves heavily white-felted beneath when mature, our no. 8365, which I have already reported as *T. heterophylla* Vent. It is a close match for many specimens from the Appalachian Upland but perhaps not for "*T. heterophylla*" as interpreted by Sargent, op. cit. 423. There, in his key, he assigns "*T. heterophylla*" "petioles not more than 4 cm. long; . . . flowers 3.5–5 mm. long", as contrasted with his proposed new *T. monticola:* "petioles up to 7 cm. in length; . . . flowers 10–12 mm. long". On p. 504, however, he describes his "*T. heterophylla*" with "Flowers 6–7 mm. long"; and under *T. heterophylla,* with "petioles not more than 4 cm. long", Sargent (p. 509) retains as var. *Michauxii* (Nutt.) Sarg. the cordate-leaved tree occurring from "southern and western New York . . . to Missouri and northwestern Arkansas, . . . Southward through Kentucky and Tennessee . . . , Georgia and . . . Alabama". If *T. heterophylla* has "petioles not more than 4 cm. long", it is most disconcerting that so many specimens from western New York, Pennsylvania, Ohio, Kentucky and Tennessee (Sargent's *T. heterophylla,* var. *Michauxii*) should have them often 5–8 cm. long: Ithaca, New York, *Palmer & Eames,* no. 792, up to 5 cm.; Alexandria, Huntingdon County, Pennsylvania, *Porter,* up to 6.5 cm.; New Bloomfield, Perry County, Pennsylvania, *Adams,* no. 1394, up to 5.3 cm., with flowers 8 mm. long; near Cincinnati, Ohio, *C. G. Lloyd,* up to 5 cm.; Garner Creek, Kentucky, *McCoy,* no. 136, up to 8.2 cm.; Anchorage, Kentucky, *Le Constant et al.,* no. 137, up to 5 cm.; etc. These, although in the range given by Sargent for his *T. heterophylla,* var. *Michauxii* and outside the range assigned by him to his *T. monticola,* can scarcely be separated from specimens cited by him under the latter. Until those who see different species in this group give us a statement of characters which really separate them it is quite unsatisfactory to attempt differentiation.

A word should be said regarding *Tilia americana* L. and *T. neglecta* Spach. Sargent (p. 424), stating that *T. americana* was based by Linnaeus upon a specimen from Kalm "not in the Linnaean Herbarium", rejected the name, since it had been used

for the northern species (*T. glabra* Vent.) and because "both *T. neglecta* and *T. heterophylla Michauxii* are more common in the part of the country which he [Kalm] visited than the tree which recent authors have called *T. americana*." The latter occurs generally from western New Brunswick across Maine and Quebec to Manitoba, thence southward, Victorin, Fl. Laurent. 382, saying of its occurrence in Quebec "Général, sauf dans le nord-est", Dole and others, Fl. Vt. 187, citing it as "common" in Vermont, and House saying of it in New York "Common in most sections of the State". Stone (Pl. So. N. J. 548) said of it in New Jersey "Common in the northern counties, and occasional southward" but he knew of no other species there; and Porter (Fl. Penn. 208) cited it from most counties of eastern Pennsylvania and no other species there. *T. neglecta* is said by Sargent (p. 492) to reach its northern limit near Montreal, though Victorin (Fl. Laurent. 382) was doubtful of its occurrence anywhere in the province of Quebec. From the doubted station near Montreal *T. neglecta* was given a range "to the coast of Massachusetts and New York, to the valley of the Potomac River and along the Appalachian Mountains to those of North Carolina and to . . . Mississippi" etc. Now, reexamination of Kalm's routes shows that he spent much time in eastern Pennsylvania, New Jersey and northern Delaware and that he went up the Hudson, through Lake Champlain, thence to Montreal and eastward to Quebec and beyond, also to the Ontario Basin of New York State, always within the area of *T. americana* as generally understood and mostly outside the ranges of the other two species. The identity of Kalm's specimen can hardly be doubted. It is, furthermore, certainly not without significance that in September, 1748, in an enumeration of the trees of the Philadelphia region, Kalm listed as no. 52 "Die Linde, in guter Erde".[1] This could have been only *T. americana* as regularly interpreted.

As to *T. neglecta* Spach (*T. Michauxii* sensu Sargent, not Nutt.), it is a baffling series with little constancy. Theoretically it should have the leaves green or merely grayish beneath, with loosely scattered stellate hairs and simple pilosity. In fact, however, few different collections can be closely matched one

[1] Kalm, Reise, i. 221 (1757).

with another. It seems to be a series very close to glabrous *T. americana,* but with some stellate or mixed pubescence. As now interpreted it is surely not a satisfactory species. I have temporarily placed here our no. 8763 from Eastover, Surry County, and our no. 13,083 from banks of the James west of Fort Boykin, Isle of Wight County. These have permanent pubescence like that of the tree of "the coast of Massachusetts" (Harwich, *Fernald & Long,* nos. 17,083 and 18,742) which Sargent (p. 495) refers to *T. neglecta.* Since, however, his key (p. 423) calls for "tufts of axillary hairs not conspicuous" and his fuller description (p. 494) says "furnished with conspicuous tufts of axillary hairs", the would-be interpreter is left high and dry. Furthermore, at the station for no. 13,083 three trees side-by-side are referable to (1) the narrow-leaved extreme of *T. heterophylla,* (2) the broader-leaved extreme of *T. heterophylla* and (3) the green-leaved *T. neglecta.* It is most difficult to imagine seeds of three different species landing on the shore of the James at this point and then producing three large trees of different species side-by-side.

SIDA RHOMBIFOLIA L. To the single Virginian station recorded (in Southampton County) add one in ISLE OF WIGHT COUNTY: roadside, Lee's Mill, no. 12,738, a single healthy plant, obviously of recent introduction.

KOSTELETZKYA VIRGINICA (L.) Presl, var. **aquilonia,** var. nov. (TAB. 688, FIG. 3 et 4), var. *typicae* simillima; calycibus floriferis 6–10 mm. altis, bracteolis 2.5–6 mm. longis; petalis 1.8–3 cm. longis 1–1.6 cm. latis; columna 0.65–1.5 cm. longa; carpellis sparse hispido-setosis, setis 0.5–1.5 mm. longis.—Long Island, New York, to Virginia. TYPE: Hudson County, New Jersey, *D. C. Eaton* in Herb. Gray.

Kosteletzkya virginica is represented in Virginia by three varieties. Typical *K. virginica* (L.) Presl, for want of better knowledge of the Linnean type of *Hibiscus virginicus* L. (which must await the present war), I am taking in the sense of the Sprague drawings published when the specific combination was ascribed to Presl by Gray in his Gen. ii. 80, pl. 132 (1849). Sprague's published plate and the drawings which form its basis were of the southern extreme which occurs from the Gulf States and Florida north to southeastern Virginia. Whereas the northern var. *aquilonia* has the leaves mostly angulate-rotund to

-ovate, with only the upper and bracteal ones becoming narrowly ovate to lanceolate and hastate, var. *typica*[1] has the narrowly ovate to lanceolate and hastate blades extending farther down the stem. In var. *typica* (FIGS. 1 and 2) the flowering calyx (FIG. 1) is 8–13 mm. high, with linear-subulate bractlets 6–10 mm. long, the expanded flower (FIG. 1) with petals 3.2–4.5 cm. long and 2–3 cm. broad, with the column of stamens and the styles 1.5–2.5 cm. long. In var. *typica*, furthermore, the carpels (FIG. 2) are copiously villous-hirsute with hairs 1.5–2 mm. long. The smaller-flowered var. *aquilonia* has the flowering calyx 6–10 mm. high, the bractlets 2.5–6 mm. long, the expanded corolla (FIG. 3) with petals only 1.8– (rarely) 3 cm. long and 1–2 cm. broad, the column 0.65–1.5 cm. long, the carpels (FIG. 4) more sparsely hispid-setose with straight setae only 0.5–1.5 mm. long.

The third variety in Virginia is var. *altheaefolia* Chapm., coarser, with copius rough tomentum on stem and foliage giving a paler and plush-like appearance, the leaves often without divergent basal lobes, the thick pedicels rarely equaling their subtending leaves (in vars. *typica* and *aquilonia* the more slender pedicels frequently overtopping the subtending leaves), the flower much as in var. *typica* but with more hispid-tomentose calyx, the carpels (FIG. 5) very heavily villous-hirsute.

Characteristic Virginia specimens of the three varieties are cited below.

KOSTELETZKYA VIRGINICA (L.) Presl. JAMES CITY COUNTY: tidal marsh along Chickahominy River west of Toano, *R. W. Menzel*, no. 270. PRINCESS ANNE COUNTY: open clay at border of woods, east of Little Creek, no. 4029. ISLE OF WIGHT COUNTY: cypress and gum swamp back of the beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,737. SURRY COUNTY: swale back of sand-beach of James River, Claremont, no. 13,691. See p. 525.

*Var. AQUILONIA Fern. PRINCESS ANNE COUNTY: border of salt marsh, arm of Lynnhaven Bay, at Third Street Bridge, Great Neck, no. 4937. NORFOLK COUNTY: brackish marsh near Kempsville, *Fernald & Griscom*, no. 2851. SURRY COUNTY: springy swale by Cobham Bay, James River, northeast of Chippokes, no. 12,736.

[1] KOSTELETZKYA VIRGINICA (L.) Presl, var. **typica.** *Hibiscus virginicus* L., Sp. Pl. ii. 697 (1753). *K. virginica* (L.) Presl ex Gray, Gen. ii. 80, pl. 132 (1849).

*Var. ALTHEAEFOLIA Chapm. PRINCESS ANNE COUNTY: brackish to fresh marsh along Back Bay, margin of Cedar Island, no. 12,409. See p. 513.

In PLATE 688 FIGS. 1 and 2 are of KOSTELETZKYA VIRGINICA (L.) Presl. var. TYPICA: FIG. 1, flowering branch, × 1, from below Rushmere (Fergusson's Wharf), Virginia, *Fernald & Long*, no. 12,737; FIG. 2, fruit, × 3, from east of Jacksonville, Onslow County, North Carolina, *Godfrey*, no. 6397. FIGS. 3 and 4, var. AQUILONIA Fernald: FIG. 3, flowers, × 1, from the TYPE; FIG. 4, fruit, × 3, from south of Hancock's Bridge, Salem County, New Jersey, *Fogg*, no. 9916. FIG. 5, var. ALTHEAEFOLIA Chapm.: fruit, × 3, from Lake Okeechobee, Florida, *Small*, no. 8218.

*HYPERICUM DENTICULATUM Walt. GREENSVILLE COUNTY: argillaceous clearing in swampy woods near Readjuster Bridge, northeast of Orion, no. 12,132. See p. 500.

H. MUTILUM L., var. LATISEPALUM Fernald. To the single recorded station add the following. KING WILLIAM COUNTY: fresh tidal marsh of Pamunkey River, Sweet Hall, no. 12,740; fresh muddy and sandy tidal shore of Mattaponi River, northwest of King William Courthouse, no. 12,739. KING AND QUEEN COUNTY: fresh tidal marsh of Mattaponi River, Walkerton, no. 12,741. NEW KENT COUNTY: fresh tidal marsh of Chickahominy River, Lanexa, no. 13,698; similar habitat, Lacey Creek, west of Walker, no. 13,697.

CROCANTHEMUM; HAS IT REALLY STABLE GENERIC CHARACTERS? (PLATES 689 and 690).—In Engler & Prantl, Die natürlichen Pflanzenfamilien, iii. Abt. 6: 304–306 (1895), Reiche followed the conservative and conventional course and held *Helianthemum* as a single genus, with several subgenera, throwing all American species, no matter what their habit, inflorescence and style-characters, into an all-inclusive subgenus *Lecheoides* (Dunal) Reiche (§ *Lecheoides* Dunal). In this course Reiche followed the best students of the past. Shortly thereafter, again in one of the Englerian series, *Halimium* (Dunal) Willk. and *Tuberaria* (Dunal) Spach were taken out of *Helianthemum*, this time by Grosser in Engler, Das Pflanzenreich, iv[193]. 9 and 10 (1903). Grosser defined the three genera recognized by him as follows.

"1. Stigma stylo brevi, recto, basi nunquam geniculato vel flexuoso suffultum. Sepala 5 vel 3. Flores aut omnes homomorphi, chasmogami, aut dimorphi, chasmogami petaliferi, multistaminei, cleistogami aut petalis minutis praedita, aut omnes apetali, oligandri. Embryo circinatus vel subcircinatus, non plicatus. Funiculi filiformes. Genus gerontogaeum et americanum............................1. *Halimium* (Dunal) Willk.

2. Stigma sessile vel stylo brevissimo suffultum. Sepala 5. Embryo periphaericus triangulariter flexus aut curvatus, non plicatus. Funiculi validi media parte inflati. Genus gerontogaeum.......2. *Tuberaria* (Dunal) Spach.
3. Stigma stylo elongato basi saepius geniculato vel sigmoideo-curvato suffultum. Embryo simpliciter vel biplicatus. Funiculi obconici, validi, non filiformes. Genus gerontogaeum..................3. *Helianthemum* Adans."

Although Grosser's statement of the characters differentiating *Halimium* clearly said "Stigma stylo brevi, recto . . . suffultum", his fuller description of *Halimium* (on his p. 33) allowed it to have "stigma subsessile", which is precariously close to his "Stigma sessile vel stylo brevissimo suffultum" for *Tuberaria*. Furthermore, although in his contrasting statements *Helianthemum* was described "Stigma stylo elongato basi saepius geniculato vel sigmoideo-curvato suffultum", Grosser allowed detailed drawings to be published, showing quite straight styles (in *Helianthemum Strickeri* Gross., in his fig. 15D; in *Helianthemum Schweinfurthii* Gross. (his fig. 16C) and in *Helianthemum aegyptiacum* (L.) Mill., his fig. 18I—our PLATE 690, FIG. 4).

All North and South American species were placed in two sections of *Halimium*, the third section being of the Old World. The first, *Halimium* § *Spartioides* Grosser, is Pacific American, plants with broom-like habit, no cleistogamous flowers, and seeds said to be numerous ("Capsula polysperma"), such species as *Helianthemum Greenei* Robinson (*H. occidentale* Greene, not Nym.), *Helianthemum scoparium* Nutt. (our PLATE 690, FIG. 5) and *Helianthemum spartioides* Presl. The second section recognized by Grosser was *Halimium*, § *Euhalimium* Grosser, Old World plants with isomorphic flowers and few or many seeds. The third of his sections was the polymorphic American *Halimium* § *Lecheoides* (Dunal) Grosser, with habit not broom-like, the flowers either uniform and showy or the later ones cleistogamous and with few ovules.

This section included such dissimilar plants as *Helianthemum carolinianum* (Walt.) Michx. (our PLATE 689, FIGS. 1–3), the type-species of *Crocanthemum* Spach, with broad rosulate leaves much as in *Tuberaria guttata* (L.) Grosser or *Helianthemum guttatum* (L.) Mill. (our PLATE 689, FIG. 4), with cleistogamous flowers so rare that, in revising *Helianthemum* for Small's Flora of the Southeastern States, ed. 2: 793 (1913), Barnhart sepa-

rated it from the other eastern American species by "Flowers all alike and petaliferous", and with the broad stigma (FIG. 3) nearly or quite as sessile as in the most extreme members of Old World *Tuberaria* (as in *Tuberaria globularifolia* (Lam.) Willk.[1], our FIG. 5), in some of which the cauline leaves are opposite or the upper alternate (PLATE 690, FIG. 1) and the flowers are "nicht selten kleistogam und dann manchmal apetal" —*Janchen; Helianthemum brasiliense* (Lam.) Pers. (our PLATE 690, FIGS. 2 and 3) with lower leaves sometimes opposite; *Helianthemum glomeratum* Lag., clearly illustrated by Grosser, l. c. fig. 11A, with opposite (instead of alternate) leaves, the petaliferous flowers (our PLATE 690, FIGS. 6 and 8) with definite styles as defined for the group, the cleistogamous flowers abundant; *Helianthemum corymbosum* Michx., which has both showy petaliferous and apetalous and cleistogamous flowers in the same corymb; *H. canadense* (L.) Michx., with the cleistogamous flowers in separate inflorescences, the broad stigma (our FIG. 10) essentially sessile; *H. propinquum* Bicknell, with slender style (fig. 11); and *H. capitatum* Nutt. (FIG. 9) and *H. rosmarinifolium* (fig. 7) also with slender styles.

In a third of the Englerian series, Die Pflanzenfamilien, Aufl. 2, Bd. 21: 300 et seq. (1925), Janchen took his turn at revising the generic lines, here following his *Bemerkungen zu der Cistaceen-Gattung Crocanthemum.*[2] Janchen felt that all the American plants ought to be treated as a single genus, because they had long been segregated geographically from the Old World ones, a type of wishful thinking too frequently taking the place of detailed studies and careful taxonomy. *Halimium* of Grosser's treatment in Das Pflanzenreich was forthwith split, throwing out all species which occur in the Americas as a separate genus, *Crocanthemum* Spach. The chief differences between *Halimium, Tuberaria* and Old World *Helianthemum* were given much as they had been by Grosser; but strictly American *Crocanthemum* was contrasted with Old World *Halimium* as having spirally arranged (instead of opposite) leaves, cleisto-

[1] On his p. 53 Grosser cited the species as *Tuberaria "globulariifolia* (Lam.) Willk.", based upon *Cistus "globulariaefolius"* Lam.; but on his p. 55 it appeared as *T. "globulariifolia* (Spach) Willk." The specific name started with Lamarck, not with Spach, and as *Cistus globularifolius*, not *"globulariaefolius"*.

[2] Janchen in Osterr. Bot. Zeitschr. lxxi. 266 270 (1922).

gamous flowers in some of the species (instead of in none), sepals 5 (instead of 3 or 5) and in being native of the Americas (instead of the Old World). If development in the New World, as contrasted with the Old World, is alone a generic character, then several of our sections of *Viola* (either with or without cleistogamous flowers) are genera; so are scores of other American subgenera, sections and series in genera also represented in the Old World. In his paper in 1922 Janchen noted that *Crocanthemum* had been taken up by Britton and by Bicknell. In regard to Britton's subscribing to *Crocanthemum* as a genus I wrote in 1917: "It is noteworthy in this connection that even Dr. Britton, under *Crocanthemum* in the *Illustrated Flora,* inserts after *C. majus* a newly recorded species for the region, not as *Crocanthemum* but as *Helianthemum georgianum,* thus indicating that the change to *Crocanthemum* was made at the last moment and apparently without very careful study of the question".[1] If the segregation of amphigean genera is justified merely because Britton or his follower, Bicknell, segregated them, then the sections of *Polygonum* must be treated as genera and we must take up *Persicaria, Bistorta, Tracaulon, Tiniaria,* &c. It is doubtful if Britton and Bicknell (who was an intensive and keenly observant local amateur) gave the thorough world-wide study to *Polygonum* that it has received from Meisner and others who have viewed it in relation to all the genera in the family and have kept it intact. It is also evident, from the above quotation, that Britton did not go extensively into the generic constancy of *Crocanthemum.*

Rehder, following the latest German treatment, that of Janchen, gives in the second edition of his Manual of Cultivated Trees and Shrubs, 644–649 (1940) the conventional Germanic characterization of *Helianthemum,* with "Style elongated, curved or bent at base; sepals 5"; leaves "mostly opposite, or the upper ones alternate, rarely all alternate". No mention is made by him of cleistogamous flowers in his *Helianthemum,* though Grosser recognized 12 species of *Helianthemum* § *Eriocarpum* with "Flores saepissime cleistogami"; and, as already noted, the

[1] Fernald in Rhodora, xix. 59 (1917). At the same time I pointed out that when Spach published *Crocanthemum* as a genus, based on *Helianthemum carolinianum,* he explicitly said "Flores omnes 5-petali"; Spach at the same time setting up for the American series with apetalous cleistogamous flowers another genus which he called *Heteromeris.*

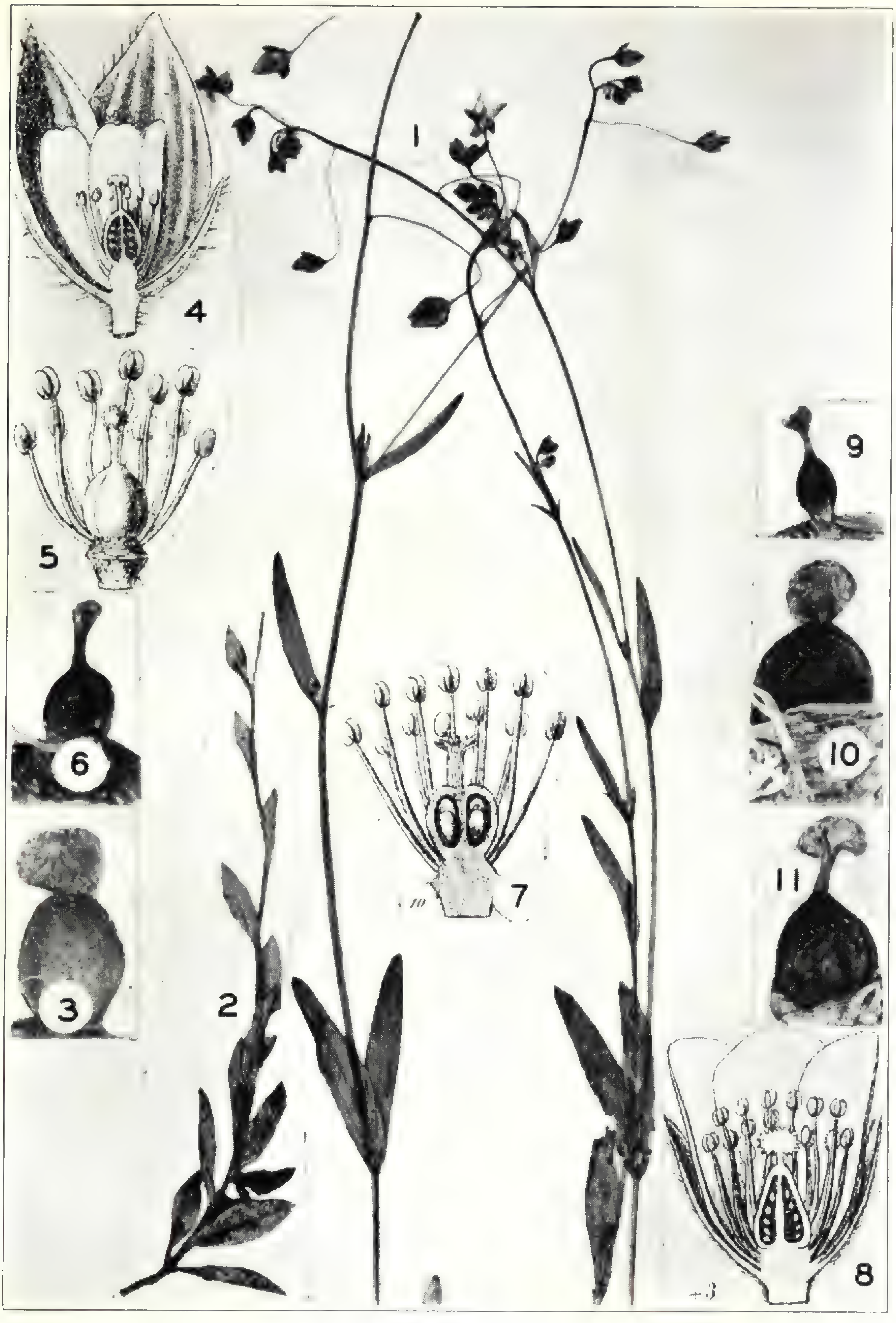

Photo. W. H. Hodge.

Helianthemum guttatum (*Tuberaria*): fig. 1, 3 fruiting stems, showing alternate leaves, × 1.

H. brasiliense (*Crocanthemum*): fig. 2, base of a stem, showing opposite lower leaves, × 1; fig. 3, ovary and sessile stigma, × 10.

H. aegyptiacum: fig. 4, section of flower, showing straight style, × 3, after *Janchen*.

H. scoparium (*Crocanthemum*): fig. 5, ovary and stamens, × 8, after *Grosser*.

H. glomeratum (*Crocanthemum*): fig. 6, ovary and style, × 10; fig. 8, vertical section of flower, × 3, after *Janchen*.

H. rosmarinifolium (*Crocanthemum*): fig. 7, vertical section of flower, × 10, after *Grosser*.

H. capitatum (*Crocanthemum*): fig. 9, ovary and style, × 10.

H. canadense (*Crocanthemum*): fig. 10, ovary and subsessile stigma, × 10.

H. propinquum (*Crocanthemum*): ovary, style and stigma, × 10.

Photo. W. H. Hodge.

HELIANTHEMUM CANADENSE: FIG. 3, fruiting stems, × 1.
Var. SABULONUM: FIG. 1, portion of TYPE; FIG. 2, portion of plant from Massachusetts.

definition, "Style elongated, curved or bent at base," for *Helianthemum,* finds exception in numerous admitted Old World species of that genus with straight and sometimes very short styles. *Halimium* is defined by Rehder with "lvs. exstipulate, the lower opposite, the upper alternate or all alternate; . . . sepals 3 or 5; . . . style short, straight, with capitate or 3-lobed stigma"; and he separates "**Crocanthemum** Spach, differing from *Halimium* chiefly in alternate lvs., the presence of small cleistogamous fls. and 5 sepals". In view of the "lvs. . . . upper alternate or all alternate; . . . sepals 3 or 5" of *Halimium* we are left only with production of cleistogamous flowers as the differentiating point in the strictly American genus *Crocanthemum;* and since the type of *Crocanthemum, Helianthemum carolinianum,* was collected for more than 150 years before it was recorded as ever producing rare and exceptional cleistogamous flowers and since several other species treated unequivocally as *Crocanthemum* (*Helianthemum Greenei, scoparium, spartioides* and others) never produce them, while the short- and straight-styled species of Old World *Helianthemum* have them, the production of cleistogamous flowers in some but not all of the species of *Crocanthemum* does not seem to me final proof that it is, therefore, a distinct genus.

As to the characters of the embryo, I have not had a sufficient series of modern Old World material to go with confidence into these somewhat erudite points; but the more obvious distinctions recently cited give us the following results (see p. 614):

In his statement in 1922 that *Crocanthemum* should be recognized as a distinct genus primarily because it is in America, not in the Old World, Janchen wrote: "It may be disputed whether such characters are sufficiently significant for one to base a separation of genera on them, and the determination of that would be to a certain degree a matter of taste, so long as it can be considered certain that both the groups under consideration have a common origin and are more closely related to each other than either of them to a third group. (Es liesse sich wohl streiten, ob solche Merkmale bedeutend genug sind, um darauf eine Gattungstrennung zu begründen, und die Entscheidung darüber wäre bis zu einem gewissen Grade Geschmackssache, so lang es als sicher gelten kann, dass die beiden in Betracht

	Duration	*Leaves*	*Flowers*	*Sepals*	*Style*
HELIANTHEMUM in the restricted sense	Herbaceous to fruticose	Opposite or alternate	Isomorphic, with expanded petals, or cleistogamous, with reduced or no petals.	5	Often geniculate or curved and elongate; or straight and sometimes short.
HALIMIUM	Fruticose to suffruticose	Opposite (or alternate, acc. to *Rehder*)	Isomorphic, with expanded petals	3 or 5	Straight and short
CROCANTHEMUM	Herbaceous to suffruticose	Alternate, the lower sometimes opposite, the basal sometimes rosulate.	Isomorphic, with expanded petals, or cleistogamous, with reduced or no petals.	5	Straight and short, with small or large stigma; or wanting and with broad sessile stigma
TUBERARIA	Herbaceous or fruticose	Opposite or partly alternate, the basal rosulate.	Isomorphic, with expanded petals, or cleistogamous, with reduced or no petals.	5	Straight and short; or wanting and with broad sessile stigma.

kommenden Gruppen gemeinsamen Ursprung haben und untereinander näher verwandt sind, als jede von ihnen mit irgendeiner dritten Gruppe)." It seems to me much less a matter of taste than of sound morphology. So long as the American series contains species which, sometimes in one, sometimes in another, exhibit differences in habit, arrangement of leaves, isomorphy or dimorphy of flowers, and development of style and of stigma, which are duplicated in the proposed generic segregates in the Old World I must await a more convincing statement before I abandon the use of *Helianthemum* for the entire group.

In PLATE 689, FIG. 1 is a plant, × 1, of HELIANTHEMUM CAROLINIANUM (Walt.) Michx. (type-species of the genus *Crocanthemum*) from south of Myrtle Beach, South Carolina, *Weatherby & Griscom*, no. 16,585; FIG. 2, a mature inflorescence, × 1, from Charleston, South Carolina, *B. L. Robinson*, no. 132; FIG. 3, ovary and sessile stigma, × 10, from Murrell's Inlet, South Carolina, *Weatherby & Griscom*, no. 16,586. FIG. 4, plant of H. GUTTATUM (L.) Mill. or TUBERARIA GUTTATA (L.) Grosser, × ½, after *Reiche* and *Janchen*. FIG. 5, ovary and stamens of HELIANTHEMUM

GLOBULARIFOLIUM (Lam.) Pers. or TUBERARIA GLOBULARIFOLIA (Lam.) Willk., × 5, after *Grosser.*

PLATE 690, FIG. 1, shows three fruiting stems of HELIANTHEMUM (TUBERARIA) GUTTATUM (L.) Mill. with upper leaves alternate, × 1, from near Placencia, Spain, *Bourgeau,* no. 2405. FIGS. 2 and 3: HELIANTHEMUM BRASILIENSE (Lam.) Pers. (*Crocanthemum brasiliense* (Lam.) Spach): FIG. 2, base of stem, showing *opposite* leaves, × 1, Rio Grande do Sul, *Bornmüller,* no. 297; FIG. 3, ovary and sessile stigma, × 10, from Dept. Maldonada Solis, Uruguay, *Osten,* no. 21,649. FIG. 4, section of flower of HELIANTHEMUM AEGYPTIACUM (L.) Mill., × 3, after *Janchen.* FIG. 5, ovary and stamens, × 8, of HELIANTHEMUM SCOPARIUM Nutt. or *Crocanthemum scoparium* (Nutt.) Millsp., after *Grosser.* FIGS. 6 and 8, HELIANTHEMUM GLOMERATUM Lag. or *Crocanthemum glomeratum* (Lag.) Janchen: FIG. 6, ovary and style, × 10, from Santiago Papasquiaro, Durango, *Palmer,* no. 56 (of 1896); FIG. 8, vertical section of flower, × 3, after *Janchen.* FIG. 7, vertical section of flower, × 10, of HELIANTHEMUM ROSMARINIFOLIUM Pursh or *Crocanthemum rosmarinifolium* (Pursh) Janchen, after *Grosser.* FIG. 9, ovary and style, × 10, of HELIANTHEMUM CAPITATUM Nutt., from Oliver, Georgia, *Curtiss,* no. 6838. FIG. 10, ovary and stigma, × 10, of HELIANTHEMUM CANADENSE (L.) Michx or *Crocanthemum canadense* (L.) Britton, from Francis Mills, New Jersey, *Long,* no. 52,124. FIG. 11, ovary, style and stigma, × 10, of HELIANTHEMUM PROPINQUUM Bicknell or *Crocanthemum propinquum* Bicknell, from Harwich, Massachusetts, *Fernald,* no. 17,161.

*HELIANTHEMUM CANADENSE (L.) Michx., var. **sabulonum,** var. nov. (TAB. 691, FIG. 1 et 2), caulibus paucis decumbentibus vel laxe adscendentibus; foliis oblongo-ellipticis plerumque supra canescentibus; floribus cleistogamicis in corymbis laxis plerumque terminalibus pedicellatis, maturis 4–5 mm. diametro.—Dunes and open sand, local, Cape Cod, Massachusetts, and Oneida Lake, New York, to southeastern Virginia. MASSACHUSETTS: dry sands along Lower County Road, Dennis, Barnstable County, September 2, 1918, *Fernald & Long,* no. 17,135.[1] NEW YORK: sandy fields at head of Oneida Lake, Verona, Oneida County, September 3, 1901, *J. V. Haberer,* no. 95.[2] VIRGINIA: dry pine barrens, Cape Henry, September 24, 1933, *Fernald & Griscom,* no. 2853 (transitional); sprawling on sand dunes south of False Cape, Princess Anne County, August 2, 1934, *Fernald & Long,* no. 4044 (TYPE in Herb. Gray.).

Typical *Helianthemum canadense* (FIG. 3) has the numerous stems erect or nearly so, the lance-oblong to oblanceolate leaves green above, the nearly sessile cleistogamous flowers few in small glomerules terminating the branches and usually scattered in spiciform series in the axils below the glomerules, in maturity

[1] Although on the original label note was made that the peculiar branching was induced by injury to the main axis, several of the specimens show no injury, and they have the oblong-elliptic leaves of the variety.

[2] One of several miscellaneous collections distributed by Haberer under the identical number.

or in fruit commonly unequal in size, the terminal ones 3–4 mm. in diameter, the lower ones smaller. In its relatively open terminal corymbs of cleistogamous fruits var. *sabulonum* somewhat suggests *H. corymbosum* Michx. It is probable that collections of the former have given rise to reports of the latter in the Gray's Manual range.

In PLATE 691, FIG. 1 is from the TYPE of HELIANTHEMUM CANADENSE (L.) Michx., var. SABULONUM Fernald; FIG. 2, from Dennis, Massachusetts, *Fernald & Long*, no. 17,135. FIG. 3 is of characteristic fruiting H. CANADENSE from Norwood, Massachusetts, August 14, 1908, *Kennedy*.

*VIOLA LATIUSCULA Greene. DINWIDDIE COUNTY: rich, deciduous woods about old marl-pits east of Burgess Station, no. 9982. SUSSEX COUNTY: rich woods and bushy clearings just east of the "fall-line" along Nottoway River, Double Bridge, about 6 miles northwest of Jarratt, no. 11,085. GREENSVILLE COUNTY: rich woods along brook entering Nottoway River below Double Bridge, north of Orion, no. 12,134.

Extension south from northwestern New Jersey and Pennsylvania. Nos. 11,085 and 12,134 closely match Greene's type. See p. 499.

*V. SEPTEMLOBA LeConte. SOUTHAMPTON COUNTY: rich sandy and loamy woods along Three Creek, northwest of Carey Bridge, no. 11,871.

Extension north from North Carolina. See p. 489.

V. PENSYLVANICA Michx. Fl. Bor.-Am. ii. 149 (1803) in part. *V. eriocarpa* Schwein. in Am. Journ. Sci. v. 75 (1822). SUSSEX COUNTY: rich woods by Nottoway River, southeast of Stony Creek, no. 12,414; our first collection on the Coastal Plain of Virginia. See p. 509.

Michaux's *Viola pensylvanica*, as shown by a photograph of the original material, was a mixture of *V. pubescens* Ait. (1789) and of *V. eriocarpa* Schwein. (1822). The former is represented by very immature plants scarcely in bloom, the latter by a plant with well-grown foliage and an old flower. Excluding the element already described (*V. pubescens*), we have material of *V. eriocarpa* remaining. By the "doctrine of residues" the latter stands as type of the Michaux name. *V. pensylvanica* grew "in umbrosis, juxta rivulos Pensylvaniae, praesertim ad *Skullkill*". It is impossible to determine whether it represented the common southern plant with white-woolly capsules or the

common northern variety with them glabrous. Since the two varieties meet in eastern Pennsylvania I am treating *V. pensylvanica* as identical with *V. eriocarpa.*[1]

*PEPLIS DIANDRA Nutt. (*Didiplis diandra* (Nutt.) Wood.). CHESTERFIELD COUNTY: margin of exsiccated old mill-pond in Swift Creek, Lakeview, no. 9439, the terrestrial forma TERRESTRIS Koehne (erroneously distributed to many herbaria and reported in RHODORA, xli. 477 and 570 (1939) as *Oldenlandia Boscii* (DC.) Chapm., which is known in Virginia only from Southampton County). SUSSEX COUNTY: back-water pool by Nottoway River at Readjuster Bridge, south of Peanut, no. 12,137, forma AQUATICA Koehne; shallow water of pond, Moore's Mill, no. 13,400. CHARLES CITY COUNTY: fresh tidal margin of Chickahominy River near Cypress Bank Landing, no. 13,399.

Extension north from North Carolina. See p. 500 and MAP 3.

AMMANNIA KOEHNEI Britton. To the few recorded stations add one in NORFOLK COUNTY: tidal marshes of North Landing River, below North Landing Bridge, no. 12,744.

A. KOEHNEI, var. EXAURICULATA Fernald. To the single known station (on North Landing River) add one in SURRY COUNTY: fresh to brackish tidal marshes, Hog Island, no. 12,745, very abundant. See p. 522.

LYTHRUM LINEARE L. Extending up the James to SURRY COUNTY: tidal marsh by Cobham Bay, northwest of Chippokes, no. 12,747.

L. LANCEOLATUM Ell. To the nearly (possibly wholly) extinct small station in Sussex County reported in RHODORA, xxxix. 342 and 436 (1937) add a very extensive one in YORK COUNTY: old-field swale north of Grafton, nos. 12,136 and 12,748. See p. 504.

EPILOBIUM COLORATUM Muhl. Local range extended down the James to ISLE OF WIGHT COUNTY: seeping argillaceous and calcareous bluffs along Burwell's Bay, below Rushmere (Fergusson's Wharf), no. 12,750. See p. 524.

SANICULA MARILANDICA L. SUSSEX COUNTY: dry sandy hickory and oak woods near Chub, no. 12,756.

Our first station for typical *S. marilandica* on the Coastal Plain. See p. 507.

ERYNGIUM YUCCIFOLIUM Michx. To the few recorded stations add two others in SUSSEX COUNTY: rich woods along Not-

[1] The plant common in eastern Canada and New England and less so southward is V. PENSYLVANICA, var. **leiocarpa** (Fernald & Wiegand), comb. nov. *V. eriocarpa*, var. *leiocarpa* Fernald & Wiegand in RHODORA, xxiii. 275 (1921).

toway River, east of Huske, no. 12,424; border of swampy woods, abundant, near Nottoway River, above Readjuster Bridge, south of Peanut, no. 13,091. See p. 509.

*Anthriscus scandicina (Web.) Mansf. (*A. vulgaris* Pers.) Dinwiddie County: waste ground and cinders of freight-yard of Norfolk and Western Railroad, Petersburg, no. 12,142, in some abundance.

Our first collection from North America; adventive from Europe. See p. 493.

Chaerophyllum Tainturieri Hook. Range extended northeastward to Surry County: clearings and borders of cultivated fields west of Ingersoll, no. 11,876; thicket back of sand-beach of James River, above Chippokes, no. 13,092. See p. 488.

*C. Tainturieri, var. floridanum Coult. & Rose. Dinwiddie County: waste ground and cinders of freight-yard of Norfolk and Western Railroad, Petersburg, no. 12,141.

Extension north from South Carolina. See p. 493.

Zizia aptera (Gray) Fernald. Sussex County: about ledges in rich woods at the "fall-line" along Nottoway River, above Double Bridge, about 6 miles northwest of Jarratt, no. 12,145. Greensville County: rich wooded slope slightly above "fall-line" by Three Creek, northwest of Emporia, nos. 11,877 and 12,760; rich woods along brook entering Nottoway River below Double Bridge, north of Orion, no. 12,144.

Our first collections of this upland plant at and below the "fall-line." See pp. 490 and 499.

Ligusticum canadense (L.) Britton. Greensville County: rich wooded slope slightly above the "fall-line" by Three Creek, northwest of Emporia, nos. 11,878, 12,143 and 12,765.

A typical plant of the Appalachian Upland here within a few rods of the inner margin of the Coastal Plain. See p. 490.

Thaspium trifoliatum (L.) Gray. Local range extended inland to Sussex County: dry woods and thickets bordering Jones Hole Swamp, west of Coddyshore, no. 10,350; sandy open woods, thickets and clearings by Nottoway River, below Peters Bridge, southeast of Lumberton, no. 12,425. See p. 507.

T. trifoliatum, var. flavum Blake. Greensville County: rich wooded slope by Three Creek, slightly above the "fall-line", northwest of Emporia, no. 11,879.

The plant of the Appalachian Upland here close to the inner margin of the Coastal Plain. See p. 490.

T. BARBINODE (Michx.) Nutt. Range extended down the James to ISLE OF WIGHT COUNTY (several nos.); plants unusually vigorous, up to 1.2 m. high.

SOME FORMS OF RHODODENDRON ATLANTICUM.—In spring, from late March into June, the sandy barrens and oak- and pinelands of the Coastal Plain from South Carolina to New Jersey are deliciously fragrant and beautifully colored by the broad colonies of *Rhododendron atlanticum,* a low species, usually only 2–6 dm. high but sometimes up to 1 m., with shallowly buried subterranean slender stolons and erect stems usually unbranched below, the strongly ascending branches with spreading stipitate glands on the young growth. Its one competitor at that season is *R. nudiflorum* (L.) Torr., taller, up to 3 m. high, with more spreading branches, the branchlets strigose-setose and glandless. In *R. nudiflorum* the corolla is essentially odorless, in *R. atlanticum* with a strong fragrance as of carnations; in *R. nudiflorum* the corolla is pilose and glandless outside (or in forma *glandiferum* (Porter) Fernald[1] with scattered glands); in *R. atlanticum* the corolla (especially the tube and throat) bears slender lines of gland-tipped spreading hairs; in *R. nudiflorum* the ovary and capsule are setose and nonglandular; in *R. atlanticum* glandular-hirsute. As a species *R. atlanticum* is very definite,[2] but in its variations in color of corolla it is most perplexing. Some of the variations have received names; others doubtless will. Unfortunately there has been a complete misunderstanding, created by the original author of the species, as to what constitutes true *R. atlanticum.* In an effort to clarify his contradiction and the confusion arising from it, I have made the following brief key to the different forms of the species already recognized. The specimens cited are in the Gray Herbarium.

[1] RHODODENDRON NUDIFLORUM (L.) Torr., forma **glandiferum** (Porter), stat. nov. *Azalea nudiflora glandifera* Porter in Bull. Torr. Bot. Cl. xxvii. 508 (1900) and Fl. Penn. 228 (1903). *R. nudiflorum,* var. *glandiferum* (Porter) Rehder in Wilson & Rehd. Mon. Azaleas, 138 (1921).

[2] Although the species received its first binomial in 1917, it was evidently known to John Clayton, whose plant was described by Gronovius in 1739:

AZALEA pusilla floribus albis in corymbos tenues dispositis: foliis oblongis glabris integris alternis: caule duro non ramoso lignoso. *Clayt.* n. 533.—Gron. Fl. Virg. 140 (1739).

a. Corolla purple or reddish to deep pink throughout.
Corolla glabrous outside except for the scattered rows of straight stipitate glands; pedicels spreading-glandular *R. atlanticum* (typical).
Corolla minutely pilose outside, the glands mixed with long villi; pedicels villous and more sparsely glandular..Forma *neglectum.*
a. Corolla white to pale pink or merely pink to purple outside toward base, or with yellowish tones toward base . . . *b.*
b. Corolla white, suffused outside or on tube with pink or purple; corolla-tube and pedicels merely glandular-hispid; buds white or pink.
Corolla-lobes uncleft..........................Forma *confusum.*
Corolla-lobes deeply cleft into linear-spatulate or linear segments or changed to stamens............Forma *tomolobum.*
b. Corolla white, suffused with yellow and salmon tints, commonly pilose on the surface as well as glandular; buds yellowish..............................Forma *luteo-album.*

*R. ATLANTICUM (Ashe) Rehder in Wilson & Rehder, Mon. Azaleas, 147 (1921) as to basinym. *Azalea atlantica* Ashe in Bull. Charlest. Mus. xiii. 26 (1917), not Ashe in Bull. Torr. Bot. Cl. xlvii. 581, 582 (1920) nor Coker in Journ. Elisha Mitchell Soc. xxxvi. 97 (1920).—Eastern South Carolina to southeastern Virginia. SOUTH CAROLINA: Society Hill, Chesterfield Co., "very common here in dry woods, very fragrant", *M. A. Curtis;* dry pinelands, 5 miles south of Conway, Horry Co., *Weatherby & Griscom,* no. 16,604; sandy woods, 5 miles south of Myrtle Beach, *Weatherby & Griscom,* no. 16,605; moist pine woods, Kinlock, near Georgetown, Georgetown Co., May 1, 1916, *W. W. Ashe* (ISOTYPE); sandy openings in pine woods, Charleston, *B. L. Robinson,* no. 247 (as *R. viscosum*). NORTH CAROLINA: mixed dry woods, Bath, Beaufort Co., *Weatherby* no. 6083; pine barren, Wilmington, April 17, 1923, *Churchill.* VIRGINIA: pine barrens, south of Lee's Mill, Isle of Wight Co., *Fernald & Long,* no. 11,880; wooded slope northeast of Statesville, Southampton Co., *Fernald & Long,* no. 7925.

In the original description of *Azalea atlantica* (1917) Ashe explicitly said "The fragrant flowers . . . are rose-purple, or reddish". It came from about Georgetown, South Carolina, and was collected "in May and June, 1916". Three years later (1920), however, he changed his mind and misquoted himself in a manner not inspiring complete confidence in his precision, saying:

"In 1916 I collected near Georgetown, South Carolina, specimens and growing plants of an Azalea which was published under the name *A. atlantica* Ashe. The flowers of this were described as pale rose-

Photo. W. H. Hodge.

RHODODENDRON ATLANTICUM, forma TOMOLOBUM, × 1.

purple [his original description, however, was "rose-purple, or reddish"!] but they are really white or nearly so, becoming purplish as they wilt, the description having been drawn from wilted specimens. A careful study of additional material and of cultivated plants seems to show that there are two closely related species, the one, *A. atlantica*, with white flowers which change to pale rose as they wilt, the other with rose-purple flowers".

There is no assurance that Ashe, collecting at different times and places, had a uniform series. If he had collected in eastern Virginia there would be every probability that the series would be quite diverse. In northeastern South Carolina the conspicuous form of the species apparently does not have white corollas; they are of an essentially uniform pink or purplish color. This is the statement of Messrs. Weatherby and Griscom, who spent much of the month of April, 1932, in Horry County and the adjacent region. Their published note was "attractive because of its large pink flowers which exhale a strong, carnation-like fragrance"—RHODORA, xxxvi. 49 (1934). Mr. Weatherby informs me that, until I showed him, he did not know that the flowers are ever white!

Although others have followed Ashe's second description, instead of the original, this course is scarcely justified. Otherwise, the shrub of eastern South Carolina with pink or roseate corollas, such as Ashe originally described, would be nameless; and, in view of Ashe's misquotation of himself and the obviously mixed elements he later studied, I am holding as typical *Rhododendron atlanticum* the form he originally described.

*Forma NEGLECTUM (Ashe) Rehder in Wilson & Rehder, Mon. Azaleas, 149 (1921). *Azalea neglecta* Ashe in Bull. Torr. Bot. Cl. xlvii. 581 (1920).—Eastern South Carolina to southern New Jersey. SOUTH CAROLINA: moist pine woods, Kinlock, near Georgetown, May 1, 1916, *W. W. Ashe* (ISOTYPE). VIRGINIA: dry open thicket, Virginia Beach, Princess Anne Co., *Fernald & Griscom,* no. 4477, *Fernald & Long,* no. 4109 (fruit from same colony as no. 4477). NEW JERSEY: moist woods near foot of Chestnut Branch, along Mantua Creek, southeast of Mantua, Gloucester Co., *Long,* no. 26,871.

Although the ISOTYPE of his *Azalea neglecta,* sent by Ashe to the Gray Herbarium, is not so extreme as the material from Virginia Beach, I am leaving them together. In the latter the villosity of pedicels and corolla is pronounced, the glands of

the pedicels being almost hidden, and the corolla has a fine pilosity over its surface. The fruit (no. 4109) is much less glandular than in other forms of the species.

Forma **confusum,** f. nov., corollis albidis vel extus roseo vel pallido purpureo suffusis.—South Carolina to eastern Maryland. Type: dry oak thicket, Virginia Beach, Virginia, May 4, 1935, *Fernald & Griscom*, no. 4479 (in Herb. Gray).

This is the most widespread form, mistakenly taken up, in spite of his original account of the roseate-flowered shrub of eastern South Carolina, by Ashe in 1920 as true *R. atlanticum.* It is very common on the Coastal Plain of North Carolina and Virginia, thence northward to eastern Maryland. It is *Azalea atlantica* sensu Ashe in Bull. Torr. Bot. Cl. xlvii. 581 (1920) and sensu Coker in Journ. Elisha Mitchell Sci. Soc. xxxvi. 97 (1920), not Ashe in Bull. Charlest. Mus. xiii. 26 (1917); also *R. atlanticum* Rehder in Wilson & Rehder, Mon. Azaleas, 147 (1921) as to plant described, not as to basinym.

*Forma **tomolobum,** f. nov. (tab. 692), corollis albidis lobis laceratis, segmentis lineari-spathulatis vel in stamina commutatis.—Virginia: a considerable colony, 6–9 dm. high, in dry white sand of pineland, southwest of Marsh Hill School, south of South Quay, Nansemond County, May 10, 1940, *Fernald & Long*, no. 11,881 (type in Herb. Gray, isotype in Herb. Phil. Acad.). See p. 491.

*Forma **luteo-album** (Coker), stat. nov. *Azalea atlantica*, var. *luteo-alba* Coker in Journ. Elisha Mitchell Sci. Soc. xxxvi. 98, pl. 1 (1920). *R. atlanticum*, var. *luteo-album* (Coker) Rehder in Wilson & Rehder, Mon. Azaleas, 150 (1901).—South Carolina to Delaware and northeastern Maryland. Rehder cites several collections from South Carolina. The following are more northern. Virginia: near Walters, Isle of Wight Co., *Fernald & Long*, no. 7626; southwest of Franklin, Southampton County, *Fernald & Long*, no. 7924. Maryland: near Elk Neck, Cecil Co., May 16, 1937, *Mary C. Henry.* Delaware: near Coopers Corners, Kent Co., May 22, 1922, *J. P. Otis.*

The distinctive marks of forma *luteo-album* are the yellowish buds and the suffusion of yellow or salmon-orange through the outside of the tube and throat, as well as a greater tendency to villosity on the tubes and the pedicels.

*R. serrulatum (Small) Millais. Prince George County: wet woods south of Templeton, at head of Jones Hole Swamp,

nos. 5870 and 13,100. SUSSEX COUNTY: wooded bottomland, Jones Hole Swamp, west of Coddyshore, no. 10,359 (distrib. as *R. viscosum*, var. *glaucum*); wooded springhead by Nottoway River, south of Chub, no. 12,426 (distrib. as *R. arborescens*). SURRY COUNTY: border of damp woods northeast of Elberon, no. 13,101. ISLE OF WIGHT COUNTY: swampy woods bordering pine barrens, south of Zuni, no. 8803 (as *R. arborescens*). SOUTHAMPTON COUNTY: wet woods, Assamoosick Swamp, south of Sebrell, nos. 10,001 and 10,301 (as *R. arborescens*); sphagnous swampy woods southwest of Applewhite's Church, no. 10,362 (as *R. arborescens*). NANSEMOND COUNTY: swampy depressions in pine barrens east of Cox Landing, south of South Quay, no. 10,762 (as *R. arborescens*); along Big Branch, east of Cherry Grove, south of South Quay, no. 11,098 (as *R. arborescens*). See p. 507.

Previously unreported from north of South Carolina, although Godfrey and others have distributed it, as *R. viscosum*, from North Carolina, as I had also done with the Virginia material. My published records of *R. arborescens* from southeastern Virginia all belong here. In the upland *R. arborescens* the young branchlets are glabrous, the leaves glabrous, calyx-lobes 3–6 mm. long, the style 6–9 cm. long, the ovary glandular-villous. In *R. viscosum* and *R. serrulatum* young branchlets are bristly or strigose, the leaves bristly or hirsute along the midrib beneath, the calyx-lobes only 1–2 mm. long, the style 4.5–6 cm. long, the ovary appressed- or ascending-pilose, only rarely glandular. *R. serrulatum* differs from *R. viscosum* in usually greater stature (up to 7 m. high), more strigose reddish or brown branchlets, floral winter-buds with 15–20 mucronate to aristate dark-bordered scales (as against 8–12 round-tipped or merely short-mucronate ones), leaves elliptic to obovate or oblanceolate, green both sides, those of the fertile branches 2.5–8 cm. long and 1.5–3.8 cm. broad, serrulate-ciliate (as against narrowly ovate or elliptic-obovate to oblong-oblanceolate ones, those of fertile branches 1.5–6 cm. long and 0.7–2.5 cm. broad, bristly-ciliate, mostly pale or glaucous[1] beneath), pedicels 1–2.3 cm. long (as against 0.5–1, rarely 1.5 cm.), corolla-tube slenderly cylindric nearly to summit, 2.5–3.5 cm. long, about the length

[1] The extreme form with leaves glaucous on both sides is
RHODODENDRON VISCOSUM (L.) Torr., forma **glaucum** (Ait.), stat. nov. *Azalea viscosa* ε. *glauca* Ait. Hort. Kew. i. 203 (1789).

of the lobes, glabrous within (as against tube gradually dilated upward, 1.5–2.5 cm. long, about equaling to once and a half as long as lobes, pubescent inside above middle of tube), style glabrous or minutely pubescent only at base (as against style pubescent up to middle) and capsule slenderly ovoid (instead of lance-cylindric). Its flowers have less of the clove-fragrance than those of *R. viscosum.*

The Varieties of Lyonia ligustrina.—*Lyonia ligustrina,* ranging from New England to Florida and Texas, is one of our polymorphous species. Michaux, knowing it from New England to Florida, described it "Magnitudine et figura admodum variant", as *Andromeda paniculata,* with two primary varieties, each of them with two subvarieties: the first "Var. 1. *nudiflora:* racemis nudis . . . in frigidioribus, per *États-Unis*", the second, "Var. 2. *foliosiflora:* racemis foliosis", with two unnamed subvarieties, "A. floribus glabellis . . . in sylvis Carolinae inferioris" and "B.—[floribus] subtomentosis . . . in stagnosis."[1] Michaux, in this early subdivision of the species indicated the complexity of the group. It is certainly a far cry from shrubs 4 dm. high, with slender quill-like stems, densely puberulent branches and cinereous-tomentulose oblong or narrowly obovate round-tipped leaves to tree-like shrubs 3 or 4 m. high, with trunks 1 dm. in diameter, glabrous branchlets and lance-acuminate glabrous leaves. Early authors saw in the extremes of the series several species, while later authors have recognized 2 species or 2 or 3 varieties; but an attempt to organize the assembled material in the Gray Herbarium leads me to the recognition of at least 5 varieties, each with a somewhat distinctive geographic range. These are outlined below.

a. Leaves of fertile branches 2.5–9 cm. long, 1–5 cm. broad, lanceolate or oblanceolate to ovate or broadly elliptic, acuminate.
  Flowers 2.5–3.5 (–4) mm. long; fruits 2.5–3 mm. long.
    Leaves thickish, rugulose, opaque, oblanceolate, obovate, elliptic or oval, abruptly short-acuminate, more or less setulose or pilose beneath or glabrate; branchlets pilose to glabrous; panicles without leafy bracts along the branches.........................Var. *typica.*
    Leaves membranaceous, lustrous above, plane, lance- to narrowly ovate-elliptic, long-acuminate, mostly glabrous; branchlets glabrous or nearly so; panicles loose, their branches with several leafy bracts.....Var. *salicifolia.*

[1] Michx. Fl. Bor.-Am. i. 255 (1803).

Flowers 4–5 mm. long; fruits 3.5–5 mm. long; leaves subcoriaceous, broadly elliptic to ovate or obovate, short-acuminate................................Var. *capreaefolia.*

a. Leaves of fertile branches 1.3–4.5 cm. long, 0.8–2.5 cm. broad, oblong to narrowly obovate, round-tipped, blunt or merely subacute or mucronate; branches of panicle more or less leafy-bracted; flowers 2.5–3.5 mm. long; fruits 2.5–3 mm. long.

Branchlets and lower surfaces of leaves glabrous or only sparingly setulose-pilose; flowers and fruits glabrescent to appressed-pilose...............................Var. *foliosiflora.*

Branchlets cinereous-puberulent; leaves cinereous-tomentulose beneath; flowers and fruits hispid-tomentulose...Var. *pubescens.*

L. LIGUSTRINA, var. **typica.** *Vaccinium ligustrinum* L. Sp. Pl. i. 351 (1753). *Andromeda paniculata* Ait. Hort. Kew. ii. 69 (1789), non L. Sp. Pl. i. 394 (1753). *A. paniculata,* var. *nudiflora* Michx. Fl. Bor.-Am. i. 255 (1803). *A. ligustrina* (L.) Muhl. Cat. 43 (1813). *Lyonia paniculata* (Ait.) Nutt. Gen. i. 226 (1818); Wats. Dendr. Brit. i. t. 37 (1825). *L. ligustrina* (L.) DC. Prodr. vii. 599 (1839). *Xolisma ligustrina* (L.) Britton in Mem. Torr. Bot. Cl. iv. 135 (1894). *Arsenococcus ligustrinus* (L.) Small, Fl. Lancaster Co. 218, 319 (1913).—Shrub 0.5–3 m. high.—Wet to dry thickets, South Carolina and northern Georgia to New England, New York, West Virginia and Kentucky.

*Var. SALICIFOLIA (Wats.) DC. Prodr. vii. 600 (1839). *L. salicifolia* Wats. Dendr. Brit. i. t. 38 (1825). *L. multiflora* Wats. l. c. ii. t. 128 (1825). *L. ligustrina,* var. *foliosiflora* sensu many auth., probably not *Andromeda paniculata,* var. *foliosiflora* Michx. (1803).—Tall shrub up to 4 m. high, with elongate membranous plane lustrous and usually glabrous acuminate leaves, and small flowers and fruits in persistently leafy-bracted loose panicles.—Damp thickets, swampy woods and low pinelands, Florida to Louisiana, north to Virginia, Kentucky, Arkansas and Oklahoma. The following, selected from many specimens, are typical: VIRGINIA: swampy or inundated woods, north of Blackwater River, Princess Anne Co., *Fernald & Long,* no. 4118 (as var. *foliosiflora*); swampy depressions in pine barrens, east of Cox Landing, south of South Quay, Nansemond Co., *Fernald & Long,* no. 10,765 (as var. *foliosiflora*); low woods, Riddick's Swamp, west of Cypress Chapel, Nansemond Co., *Fernald & Long,* no. 7567 (as var. *foliosiflora*); wooded swamp, about 7 miles south of Franklin, Southampton Co., *Fernald & Long,* no. 10,006 (as var. *foliosiflora*). NORTH CAROLINA: swamp, 1 mile southwest of South Mills, Camden Co., *Wiegand & Manning,* no. 2398 (as var. *foliosiflora*); swamp bordering Mill Creek, north of Perquimans River, Parkville, Perquimans County,

Wiegand & Manning, no. 637; shrub bog, 2 miles south of Columbia, Tyrell County, *Godfrey & Kerr*, no. 3927 (close match for original plate of *L. multiflora* Wats.). Georgia: sandy swamp of Ochlocknee Creek, near Moultrue, Colquitt Co., *Harper*, no. 1673 (leaves unusually broad, pilose beneath). Kentucky: Pine Mountain, Bell Co., *Kearney*, nos. 417 and 550 (the latter as *Gaylussacia ursina*). Tennessee: side of Gregory's Bald, Blount Co., June 29, 1930, *Jennison;* thicket along stream between Altamont and Palmer, Grundy Co., *Svenson*, no. 7138. Alabama: Tallapoosa Co., August 21, 1897, *F. S. Earle;* 8 miles north of Headland, Henry Co., *Wiegand & Manning*, no. 2396. Arkansas: along Cove Creek near Martinville, Faulkner Co., *E. J. Palmer*, no. 26,521; flat woods, Malvern, Hot Springs Co., *Demaree*, no. 11,042; near entrance to Ouchita National Forest, Pike Co., *Demaree*, no. 9792; Salt Gum Ford, Murfreesboro, Pike Co., *Demaree*, no. 9361; Camden, May 14, 1850, *Fendler.* Louisiana: tupelo swamp, 3 miles northeast of Franklinton, Washington Parish, *Correll & Correll*, no. 9198; swampy woods, 4 miles west of Minden, Webster Parish, *Correll & Correll*, no. 10,270. Oklahoma: thicket, Page, Laflore Co., *O. W. Blakeley* (*G. W. Stevens*, no. 1427); thicket, valley of mountain creek, Page, Laflore Co., *G. W. Stevens*, no. 2654.

Although var. *salicifolia* has usually been called var. *foliosiflora*, there is such doubt of its identity with *Andromeda paniculata*, var. *foliosiflora* Michx. as to support taking up var. *salicifolia*, about which there can be no question. Watson's plate of *Lyonia salicifolia* was wholly characteristic and his detailed description was equally so: branches glabrous; leaves long-lanceolate, acuminate, shining, with the special note, "closely allied to *paniculata*, but its lanceolate, shining, less pubescent leaves and other particulars sufficiently distinguish it." DeCandolle's brief diagnosis of var. *salicifolia* was "foliis lanceolatis glabriusculis sublucidis." Michaux's *Andromeda paniculata*, var. *foliosiflora* was very briefly described and with two subvarieties, one with glabrate, the other with subtomentose flowers [leaves?] and it came from South Carolina. In all the accumulation of material in the Gray Herbarium no specimen from South Carolina has come to hand of the long- and acuminate-leaved var. *salicifolia*. North of Georgia it is shown in our collection only by 15 numbers from southeastern Virginia and adjacent northeastern North Carolina (mostly north of Albermarle Sound). From South Carolina, on the other hand, we have copious material

of two small shrubs with small blunt leaves, one of them glabrous, the other subtomentose. (It is surmised that Michaux's "floribus glabellis" and "floribus subtomentosis" had *floribus* inadvertently substituted for the more significant *foliis*). The glabrous dwarf shrub with blunt leaves is represented in the Gray Herbarium by 24 numbers from "mixed woods", "thickets", "clearings", "pinelands", "shrub-bogs" and "savannahs" of South Carolina and southeastern North Carolina. Habitally it is quite like var. *pubescens,* which has cinereous-tomentulose leaves and which we have only from shrub-bogs and pinelands of South Carolina and Georgia. Until photographs are available to disprove my interpretation I am taking up as Michaux's *Andromeda paniculata,* var. *foliosiflora,* "A floribus [foliis?] glabellis . . . in sylvis Carolinae inferioris" the glabrous or glabrate blunt-leaved shrub which is so well represented from South Carolina, while the similar var. *foliosiflora* "B. floribus [foliis?] subtomentosis . . . in stagnosis" seems to be the tomentose *L. ligustrina,* var. *pubescens* of "shrub bogs" of South Carolina.

*Var. CAPREAEFOLIA (Wats.) DC. Prodr. vii. 600 (1829). *L. capreaefolia* Wats. Dendr. Brit. ii. t. 127 (1825).—Panicle naked or more or less leafy-bracted; flowers 4–5 mm. long; fruits 3.5–5 mm. long.—Local, Florida to eastern Texas, north to southeastern Virginia, western North Carolina, Tennessee and Arkansas. VIRGINIA: swampy woods east of Joyner's Bridge, Isle of Wight Co., *Fernald & Long,* no. 12,340. NORTH CAROLINA: Blowing Rock, Watauga Co., June 18, 1899, *Churchill;* Linville, Avery Co., *Hunnewell,* no. 9277; woods, Hot Springs, Madison Co., June 1, 1899, *Churchill.* FLORIDA: New Smyrna, 1874, *Edw. Palmer,* no. 322. TENNESSEE: White Cliff Springs, July 16, 1894, *Kearney;* near Roan Mountain Station, June 20, 1900, *Rehder* (Arnold Arb.). ARKANSAS: creek-beds, Pulaski Heights, Pulaski Co., *Demaree,* no. 8227; small stream, Langley, Pike Co., *Demaree,* no. 9517. LOUISIANA: wet soil, edge of pocosin, 4 miles west of Winnfield, Winn Parish, *Correll & Correll,* no. 10,039. TEXAS: near Texarkana, Bowie Co., *Heller & Heller,* no. 4098.

Although neither Watson nor DeCandolle noted the large flowers and fruits of var. *capreaefolia,* Hart, Watson's artist, caught them, showing practically all the flowers 5 mm. long, whereas Watson's other plates, of *Lyonia multiflora, paniculata* and *salicifolia,* showed smaller flowers.

Var. foliosiflora (Michx.) Fernald in Rhodora, x. 53 (1908) as to basinym. *Andromeda paniculata*, var. *foliosiflora*, A. Michx. Fl. Bor.-Am. i. 254 (1803). *Xolisma foliosiflora* (Michx.) Small, Fl. Se. U. S. 889, 1336 (1903), at least as to basinym.—Low (0.4–2 m. high), with glabrous or glabrescent branchlets and leaves; the latter firm, oblong to oblong-obovate, 1.3–4.5 (–5.5) cm. long, glabrous; inflorescences lax, leafy-bracted, small-flowered.—Thickets, pinelands, shrub-bogs and savannahs, Florida to eastern North Carolina. The following, selected from many numbers, are characteristic. North Carolina: pineland near Roper, Washington Co., *Godfrey*, no. **4299**; shrub-savannah, 7 miles south of Washington, *Godfrey*, no. **4408**; peaty thicket, 4 miles east of Grimesland, Pitt Co., *Wiegand & Manning*, no. **2392**; dry or peaty thicket near Saratoga, Wilson Co., *Wiegand & Manning*, no. **2399**; 12 miles northwest of Chapel Hill, Orange Co., *Wiegand & Manning*, no. **2393**; moist grassy clearing near Erwin, Hartnett Co., *Godfrey*, no. **4226**; boggy place, west of Laurel Hill, Scotland Co., *Wiegand & Manning*, no. 2401; savannah near Havelock, Craven Co., *Godfrey*, no. **4415**; savannah near Richlands, Onslow Co., *Godfrey*, no. **4476**; savannah near Old Dock, Columbus Co., *Godfrey & Shunk*, no. **4188**. South Carolina: shrub-bog, 3 miles southwest of Manning, Clarendon Co., *Godfrey & Tryon*, no. 905; swampy oak-tupelo woods, 4 miles south of Bonneau, Berkeley Co., *Wiegand & Manning*, no. **2402**; swampy, shrubby, peaty woods, 8 miles southwest of Moncks Corners, *Godfrey & Tryon*, no. **1405**; low, sandy, mixed woods, Summerville, *Robinson*, no. **150**; shrub-bog, 6 miles northwest of McClellanville, Charleston Co., *Godfrey & Tryon*, no. **1139**; clearing, near Beaufort, May 5, **1917**, *Churchill*. Georgia: border of swamp, Augusta, *A. Cuthbert*, no. 1101; wet pine barrens, Bulloch Co., *Harper*, no. **888**. Florida: South Jacksonville, April 14, **1897**, *Churchill;* swamps, vicinity of Eustis, Lake Co., *Nash*, no. **528**.

See discussion under var. *salicifolia*.

Var. pubescens (Gray) Rehder in Bailey, Stand. Cycl. Hort. iv. 1935 (1916). *A. paniculata*, var. *foliosiflora*, B., Michx. Fl. Bor.-Am. i. 255 (1803). *A. tomentosa* Dum.-Cours. Bot. Cult. ed. 2, iii. 495 (1811). *A. frondosa* Pursh, Fl. Am. Sept. i. 295 (1814). *L. frondosa* (Pursh) Nutt. Gen. i. 267 (1818). *A. ligustrina*, var. *pubescens* Gray, Syn. Fl. ii. 33 (1878). *L. ligustrina pubescens* Rehder in Bailey, Cycl. Am. Hort. i. 62 (1900) without citation of basinym nor (as a trinomial) designation of rank; also Rehder, Man. Cult. Trees and Shrubs, ed. 2: 733 (1940), trinomial wrongly ascribed to Gray. *Xolisma ligustrina*, var. *pubescens* (Gray) Millsp. Living Fl. W. Va.

324 (1913), as to basinym only. *Arsenococcus frondosus* (Pursh) Small, Shrubs of Fla. 97, 133 (1913), as to basinym.—Dwarf; branchlets cinereous-puberulent; small coriaceous blunt leaves cinereous-tomentulose; flowers and fruits cinereous.—Bogs and pinelands, South Carolina and Georgia. SOUTH CAROLINA; pineland, 2 miles west of Salters, Williamsburg Co., *Godfrey & Tryon,* no. 528; shrub-bog, 3 miles southwest of Manning, Clarendon Co., *Godfrey & Tryon,* no. 906; shrub-bog, 6 miles northwest of McClellanville, Charleston Co., *Godfrey & Tryon,* no. 1106. GEORGIA: Savannah, *Nuttall* (TYPE of *L. frondosa* Nutt., who thought his species perhaps not *Andromeda frondosa* Pursh; also TYPE of *A. ligustrina,* var. *pubescens* Gray).

I am indebted to Professor Rehder for the use of a sheet of *Andromeda tomentosa* Dum.-Cours.

GALAX APHYLLA L. To the relatively few recorded Coastal Plain stations add one in SURRY COUNTY: rich wooded ravine west of Eastover, no. 11,717. See p. 486.

BUMELIA LYCIOIDES (L.) Pers., var. VIRGINIANA Fern. Add a station in ISLE OF WIGHT COUNTY: border of cypress swamp back of the beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,769. Also one in PRINCE GEORGE COUNTY: thickets and woods back of beach of James River, Windmill Point, Flowerdew Hundred, no. 13,106. See p. 523.

SABATIA STELLARIS Pursh (*S. amoena* (Raf.) G. Don). Extending up the James to SURRY COUNTY: fresh to brackish tidal marshes, Hog Island, no. 12,773. See p. 522.

When, in 1932, I took up the name *Sabatia amoena* (Raf.) G. Don (1837), based on *Chironia amoena* Raf. (1808), to displace *Sabatia stellaris* Pursh (1814), I did so because Pursh's specific name was later than that of Rafinesque. There is an illegitimate *Chironia amoena* Salisb. Parad. 137 (1796) which, as a mere substitute for the earlier *C. linoides* L., cannot be used. In 1932 I did not grasp the full absurdity of the provision of the International Rules, that, even though such names are wholly illegitimate, they have enough spurious validity to prevent the use of the same name properly published for another species. Since, when Don made the combination *Sabatia amoena* (Raf.) G. Don, the specific name of Pursh (1814) was available, under the rules adopted a century later he ought to have taken up Pursh's name. If Pursh's specific name had not been available, then Don's combination would be quite valid! In

this instance (though not always) the working of the tricky rule is fortunate and *Sabatia stellaris* stands.

*S. stellaris, forma albiflora Britton. Surry County: with and more abundant than the last, no. 12,774. See p. 522.

S. calycina (Lam.) Heller. Range extended north to James River. Isle of Wight County: cypress and gum swamp back of the beach, below Rushmere (Fergusson's Wharf), no. 12,775. See p. 525.

(*To be continued*)

AQUATIC VARIETIES OF POA ANNUA

Julian A. Steyermark

A large number of varieties, subvarieties, and forms of the common Low Spear Grass (*Poa annua* L.) have been described, practically all of them from European material. Ordinarily, this species is an annual-rooted plant found throughout Missouri, especially in fields, gardens, and grassy lawns of towns and cities. However, in the large cold springs of the Ozarks in southern and central Missouri, it occupies an unusual habitat and becomes an aquatic plant. In a submerged state it becomes rooted to the gravel or sand on the bottom or sides of the spring, whose water remains throughout the year at the average temperature of 52–58° F. and is always fresh and flowing. Not only do the plants growing in these spring waters become perennial, but the stems and especially the leaves become elongated, broader, and more flaccid, and the inflorescence becomes more loosely flowered and often elongated with ascending branches. Usually the plants are found in shallow swiftly running water and grow prostrate or elongate, usually parallel to the direction of flow of the current. Another unusual condition encountered is that the inflorescence is developed and anthesis proceeds even though the plant is in the submerged state. This variation in *Poa annua* occurs abundantly throughout the Ozark springs. Transitional habitats also occur, as, for example, where plants have rooted at the margins of a spring, and part of the plant is submerged, while another part of it is out of the water. In the same area a few feet away on ordinary land occur typical terrestrial plants of *Poa annua*, with shorter, firmer, and narrower leaves and culms, and more contracted inflorescences with spreading branches. In correspond-

ence with Mrs. Chase the writer learned that Mr. Swallen had growing in his garden a patch of *Poa annua* which has persisted for several years, so that evidently it is apparently easy for the ordinarily annual habit to become changed into a perennial one.

The aquatic perennating *Poa annua* of Missouri springs fits two varieties, *Poa annua* L., var. *aquatica* Aschers. and *Poa annua* L., var. *reptans* Haussknecht, described by Ascherson and Graebner in Syn. Mitteleur. Fl.[1] and by Hegi in Ill. Fl. Mittel-eur.[2] In the latter publication *Poa annua* L., var. *reptans* is described as with "Stengel verlangërt, niederliegend, stark verzweigt, an den Knoten wurzelnd. Wahrscheinlich ausdauernd.—Selten auf feuchtem, begrastem Sandboden", while *Poa annua* L. var. *aquatica* is described "Pflanze sehr zart und schlaff, an Catabrosa aquatica erinnernd. Stengel zuweilen stark verlängert. Rispe sehr locker.—Selten an sumpfigen Stellen, zuweilen im Wasser schwimmend". Although the habitat of *Poa annua* var. *aquatica* would appear to fit that of most of the specimens from the Missouri Springs, yet the description given for *Poa annua* var. *reptans* seems to hold for the majority of the plants encountered; nevertheless, transitional specimens which might be placed in either variety occur in the Missouri material. For the sake of record, the following Missouri collections made by the writer may be given and may be found in the Herbarium of the Field Museum of Natural History.

Poa annua L., var. *aquatica* Aschers.—This is represented from Missouri by *Steyermark 6638* from Steelville Spring, at Steelville, Crawford Co., Sept. 17, 1938.

This collection exhibits the delicate and lax habit with greatly prolonged stems characteristic of this variety.

Poa annua L., var. *reptans* Haussknecht.—This is represented from Missouri by the following collections: *Steyermark 27938*, rooting on gravel, Paydown Spring branch at Paydown, Maries Co., Aug. 12, 1939; *Steyermark 21938*, submerged in Mill Spring, Wayne Co., April 28, 1939; *Steyermark 23030*, spring branch of Ike Raines Spring, tributary to Swan Creek, T 26 N, R 19 W, sect. 34, 3½ mi. southeast of Chadwick, Christian Co., July 6, 1937; *Steyermark 4643*, Slabtown Spring, T 33 N, R 10 W, sect. 15, 5 mi. south of Edanville, Texas Co., April 13, 1937; *Steyermark 21229*, submerged in water of Reeds Spring, T 32 N, R 1 E, sect. 28, ½ mi. east of Centerville, Reynolds Co., March 21,

[1] Ascherson, P. and P. Graebner, Synopsis der Mitteleuropäischen Flora 2[1]: 388–389. 1921.

[2] Hegi, G. Illustrierte Flora von Mittel-Europa 1: 302. 1908.

1937; *Steyermark 21159*, Wilkins Spring, T 36 N, R 9 W, S ½ SE ¼ sect. 17, 7 mi. southwest of Newburg, Phelps Co., Feb. 6, 1937; *Steyermark 21246*, in water of Big Spring, T 26 N, R 1 E, sect. 6, 4 mi. southeast of Van Buren, Carter Co., March 21, 1937; *Steyermark 4659*, Thomasson Mill Spring, ¼ mi. from "The Narrows" near mouth of Fredericks Fork, between Calm and Myrtle, T 22 N, R 2 W, sect. 16, Oregon Co., April 11, 1937; *Steyermark 21173*, Roubidoux Spring, near Waynesville, T 36 N, R 12 W, along highway 17, Pulaski Co., Feb. 28, 1937; and *Steyermark 4538*, submerged in Chesapeake Spring, in T 28 N, R 25 W, SW ¼ SW ¼ sect. 21, at Chesapeake, Lawrence Co., April 19, 1937.

Field Museum of Natural History,
Chicago.

Another Massachusetts Station for Serapias Helleborine.—While botanizing on August 6, 1941, on Mount Greylock, I walked down from the summit to the Bellows Pipe and then followed the bed of Notch Brook northward, down stream. Fifty minutes after leaving the Bellows Pipe I came upon a plant, growing at the water's edge, with the habit of a Habenaria but with a saccate lip. It proved to be *Serapias Helleborine* L. It was 59 cm. high with a spike 15 cm. long bearing 26 flowers. There was a second smaller stem which had been somewhat injured but which bore several flowers. This I took for a record specimen. I later left the bed of the brook and came back to the Bellows Pipe by way of the trail west of the brook. Some 50 feet to the right (west) of the trail, where it emerges from the woodland into the open weedy pasture of the Bellows Pipe, I came upon another specimen of *Serapias* (in the woodland) which was of the same height as the first one but with a spike 20 cm. long bearing 29 flowers. The plants were probably a third or perhaps a half mile apart and far—miles probably—from any habitation and with no drainage from a habitation. The specimens I found were growing in the town of Adams. A few days later I found another good sized specimen in full flower at the mouth of the Inner Hopper on the west side of Greylock, this location being in Williamstown. John Osmun, son of Prof. A. V. Osmun, head of our Department of Botany, tells me that in woodland in the northern part of Pittsfield, just east of Pontoosuc Lake, "Serapias grows by the thousand."—Arthur K. Harrison, Massachusetts State College.

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JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 43. **December, 1941.** **No. 516.**

CONTRIBUTIONS TO THE BOTANY OF MICHIGAN, NO. 18

Oliver A. Farwell

This paper deals with extension of ranges, the most interesting of which probably is the finding of *Solidago hispida* var. *tonsa* in Michigan.

Potamogeton capillaceus Poir. Anderson's Pond, Clifton, Keweenaw Co., no. 857, July 5, 1895.

This is the "*P. diversifolius* Raf." of Beal's *Michigan Flora*. In his monograph of the Linear-leaved North American Species of *Potamogeton* sect. *Axillares*, Fernald excludes Michigan from the range of distribution of this species, citing no specimens from this State. This collection from Michigan closes the gap between Wisconsin and New York, thus making the range continuous.

Chaetochloa viridis (L.) Scribn. var. minor (Koch) O. A. F. (var. *Weinmanni* (R. & S.) House). Lake Linden, no. 11130, Sept. 21, 1935; along the shores of Torch Lake, no. 11479, Aug. 11, 1936.

This purplish-bristled variety has been found in the Lake Superior country along roadsides in Houghton Co., extending the Michigan range far to the north.

Deschampsia cespitosa (L.) Beauv. On conglomerate shores of Lake Superior near Eagle Harbor, Keweenaw Co., no. 12537, July 30, 1940.

This species is limited by Fernald (Rhodora xxviii. 153 (1926) to Newfoundland and the western mountainous region. Michi-

gan is now included. The var. *glauca* (Hartm.) Lindm. f. also occurs and both are rare here.

Juncus inflexus L. (*J. glaucus* Ehrh.) This European species is very abundant on wet banks near Hancock where it was discovered by F. J. Hermann in 1936. On the Quincy Hill, Houghton Co., no. 12735, Sept. 17, 1940.

It is otherwise known in North America only from New York, having been reported from Oneida Co. by House and from the Cayuga region by Wiegand and Eames. Superficially it looks like *J. balticus* but the plant is densely caespitose and glaucous and the inflorescence is more condensed.

Juncus marginatus Rostk. With the preceding species and quite plentiful. No. 12760, Oct. 8, 1940.

This is far to the north of the range as generally given—Maine to Nebraska. Associated with these is

J. bogotensis HBK. var. compactus (Lej. & Court.) O. A. F. This is very scarce at this station, no. 12757, Oct. 8, 1940.

Linum catharticum L. Purging Flax. Near the Central Mine, Keweenaw Co., no. 12555, Aug. 6, 1940.

Said to occur only in Newfoundland,[1] Nova Scotia, Maine,[2] New York[3] and Ontario, where it is chiefly adventive from Europe. It was found in abundance in grassy borders of U. S. Highway 41.

Campanula uliginosa Rydb. In swampy meadows, Meadow Mine, no. 12495, July 30, 1940; Cat Harbor, no. 12608, Aug. 8, 1940.

First time reported for the mainland of Keweenaw Co., Michigan. It has been reported by others from various parts of Michigan. H. T. Darlington reported it from the Porcupine Mountains and Cooper from Isle Royale. My sincere thanks are herewith tendered Dr. M. L. Fernald for the following list of sheets of this species from Michigan in the Gray Herbarium:—Grayling, Crawford Co., 1922, *C. V. Piper;* Fayette, 1901, *M. A. Barber;* Hamlin Lake, Ludington, Mason Co., 1910, *R. W. Chaney;* an old collection marked "Mich. State collection" by *Asa Gray;* Mud Lake, Cheboygan Co., *Ehlers,* no. 604; Turin, Marquette Co., 1901, *Barlow;* Isle Royale, 1901, *Cooper.*

[1] Fernald, Rhodora, xxxv. 15 and 277 (1933).
[2] Walter Deane, Rhodora, xiv. 56 (1912).
[3] House, N. Y. State Museum Bulletin, no. 266: 23 (1925).

Solidago hispida Muhl. var. tonsa Fernald. On dry soil of exposed bluff, Lookout Mt., Keweenaw Co., nos. 12706 and 12710, Aug. 27, 1940.

Originally described as from Newfoundland, Quebec and New Brunswick, it is now found in the Lake Superior district.

Helianthus laetiflorus Pers. In dry open places, Oakwood, Wayne Co., no. 8822, Sept. 30, 1930. Shores of Torch Lake, Houghton Co., no. 12768, Oct. 14, 1940.

Not before reported for Michigan which is north of the general range as usually given.

Lake Linden, Michigan.

ANOTHER CENTURY OF ADDITIONS TO THE FLORA OF VIRGINIA

M. L. Fernald

(*Continued from page 630*)

*Symplocos tinctoria (L.) L'Hér., var. **pygmaea,** var. nov., frutex nanus 0.3–1.3 m. altus; foliis maturis elliptico-ovatis utrinque acutis 2–5.5 cm. longis 1–2.5 cm latis.—Southeastern Virginia: white sand of dry pine barrens, south of Lee's Mill, Isle of Wight County, August 23 and September 2, 1940, *Fernald & Long*, no. 12,770 (type in Herb. Gray; isotype in Herb. Phil. Acad.); open ground near Norfolk, May 17, 1877, *Thos. Morong*. See p. 519.

Typical *Symplocos tinctoria* is a large shrub or small tree (up to 6 m. high), with mature leaves 0.7–1.5 dm. long and 3–6 cm. broad. The small shrub of the pine barrens may prove, when we can secure flowering and fruiting material, to have other points of departure. Var. *Ashei* Harbison, described from the mountains of North and South Carolina, Georgia and Tennessee, is a tree or large shrub, with leaves much larger than in var. *pygmaea*.

Apocynum sibiricum Jacq. Range extended south to Isle of Wight County: sandy beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,777. Also Prince George County: woods and thickets back of beach of James River, Windmill Point, Flowerdew Hundred, no. 13,110.

Asclepias purpurascens L. To the very few recorded stations add others in York, Sussex and Greensville Counties (several nos.). See pp. 499 and 504.

Convolvulus sepium L., var. americanus Sims. To the single Virginian station (Buckroe, Elizabeth City County) cited by Tryon in Rhodora, xli. 420 (1939) add one in Princess Anne County: moist sandy depressions back of the dunes, Sand Bridge, no. 12,440.

*C. sepium, var. fraterniflorus Mackenz. & Bush. Henrico County: margin of canal from James River, Richmond, no. 12,171.

The range given by Tryon, op. cit. 422 is "Illinois to Montana, south to Arkansas and New Mexico". See p. 495.

*Jacquemontia tamnifolia (L.) Griseb. James City County: weed in abandoned corn-field about 5 miles west of Toano, *R. W. Menzel*, no. 349.

Pantropical weed, not previously recorded from north of South Carolina.

Phlox maculata L. Sussex County: alluvial woods along Nottoway River at Readjuster Bridge, south of Peanut, no. 12,444.

Our first station on the Coastal Plain of Virginia. See p. 510.

Heliotropium europaeum L. To the few recorded stations add one in Dinwiddie County: waste ground and cinders of freight-yard of Atlantic Coast Line, Petersburg, no. 12,172. See p. 493.

Myosotis verna Nutt. To the very few stations in southeastern Virginia add one in Henrico County: border of woods, east of Fulton Hall, no. 12,175.

I am taking up the unequivocal name *Myosotis verna* Nutt. Gen. ii. Addenda (1818) instead of the wholly equivocal *M. virginica* (L.) BSP. (1888) which has recently replaced it. The combination of Britton, Stern & Poggenberg, published without bibliographic reference to its basinym, was said in Britton's later works to rest upon *Lycopsis virginica* L. Sp. Pl. 139 (1753). That, in turn, rested wholly upon the *Lycopsis foliis lineari-lanceolatis*, etc. of Gronovius, Fl. Virg. pars. 2: 140 (1743), based upon a *blue-flowered* weed of a roadside, collected by Clayton: "flore minimo coeruleo . . . Crescit juxta vias publicas loco sterili"—Clayton's account quoted by Gronovius. A blue-flowered roadside weed can hardly be taken as identical with the white-flowered indigenous American plant. Just what Clayton had as the basis of *Lycopsis virginica* L. can be determined

only when the Clayton specimen (at the British Museum) can be critically studied. Whether it was one of the several blue-flowered Old World species of *Myosotis* adventive in America or perhaps a species of *Lappula* can only be surmised. It is not improbable that *Lycopsis virginica* L. (1753) may be the basinym for some European species!

M. macrosperma Engelm. Local range extended into rich or alluvial woods of Henrico, Dinwiddie, Sussex and Greensville Counties (many nos.). See p. 488 and map 1.

Myosotis macrosperma has been stretched to include large states of *M. verna* and its specific characters have, consequently, been quite obscured and its range made nearly coincident with that of the latter species. Restudy of the two shows that, whereas *M. verna*, a plant of thin or sterile soils, has three areas of development (New England to Minnesota, south to northern Florida, Tennessee, Oklahoma and Texas; Idaho to southern British Columbia, south to Wyoming and California; southern South America), *M. macrosperma* is a plant of rich, mostly calcareous woodlands and bottoms, with a broad austro-riparian range (Florida to eastern Texas, north to Maryland, the District of Columbia, Kentucky, southern Indiana, southern Illinois and Missouri). I distinguish the two as follows:

M. verna. Simple or with stiff upright branches, 1–4 dm. high; principal leaves 2–10 mm. broad; racemes in maturity elongating to 0.3–1.8 dm. long; fruiting pedicels 1–5(–6) mm. long, erect and nearly parallel with rachis, the lowest 0.5–2 cm. apart; fruiting calyx 4–6 mm. long, persistent on the pedicel, the tube with few straight or slightly hooked short bristles, the base with mostly reflexed and appressed strigae; nutlets 1–1.3 mm. broad, the strophiole 0.4–0.5 mm. broad.

M. macrosperma. Lax or loosely branching stem 1.5–8 dm. long or high; principal leaves 0.5–1.7 cm. broad; central raceme in maturity elongating to 1.2–4.7 dm. long; fruiting pedicels 3–10 mm. long, loosely spreading-ascending from base, the lowest 2–5 cm. apart; fruiting calyx 5.5–9 mm. long, promptly disarticulating from tip of pedicel, the tube covered to base with hundreds of strongly hooked upcurving long bristles (enabling fruiting calices to adhere to passing animals); nutlets about 2 mm. broad, the strophiole 0.5–0.8 mm. broad.

*Lithospermum carolinense (Walt.) MacM. Sussex County: dry sandy woods and clearings near and south of Chub, nos. 12,173, 12,449 (narrow-leaved) and 12,450 (broad-leaved).

First from north of South Carolina. See pp. 498 and 506.

Scutellaria parvula Michx., var. ambigua (Nutt.) Fernald. Sussex County: sandy open woods, thickets and clearings by Nottoway River, below Peters Bridge, southeast of Lumberton, no. 12,458.

Our first Coastal Plain station for a characteristically inland plant. See p. 507.

S. nervosa Pursh. Dinwiddie County: rich sandy and loamy wooded slopes and clearings along Appomattox River, just above the "fall-line," about 2 miles west of Petersburg, no. 11,905.

An upland species here closely approaching the Coastal Plain. See p. 490.

*Lamium amplexicaule L., forma clandestinum (Reichenb.) G. Beck. Greensville County: lawns and grassland, Emporia, no. 11,725.

Flowers minute and cleistogamous; our other collections from southeastern Virginia have showy and expanded corollas. See p. 486.

Stachys Nuttallii Shuttlew. To the extraordinarily isolated station already reported add another, also in Surry County: thicket back of sand-beach of Cobham Bay, James River, northwest of Chippokes, no. 12,788; stems up to 1.5 m. high, with moniliform inflorescences up to 3 dm. long. See pp. 520 and 521.

Monarda mollis L. Southampton County: waste ground, Franklin, no. 12,460.

Our first Coastal Plain station; probably from garden-refuse.

Pycnanthemum Torrei Benth. Southampton County: rich woods and thickets near Raccoon Creek, north of Mill Neck Church, no. 12,462.

Our first Coastal Plain station for an upland species; identification confirmed by Miss Elizabeth Boomhour. See p. 508.

Cunila origanoides (L.) Britton. Local range extended to Surry County: dry wooded slopes of ravines west of Claremont, no. 12,789. See p. 521.

Lycopus europaeus L. To the few recorded stations add the following. Surry County: springy swale by Cobham Bay, James River, northwest of Chippokes, no. 12,790. Isle of Wight County: along path in cypress and gum swamp back of beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,791.

Mentha longifolia (L.) Huds. To the few recorded stations add one in King William County: border of fresh tidal marsh of Pamunkey River, Sweet Hall, no. 12,792.

VERBASCUM LYCHNITIS L. YORK COUNTY: open thicket by York River above Yorktown, no. 12,181. See p. 505.

VERONICA HEDERAEFOLIA L. HENRICO COUNTY: abundant in an open field, Fulton Hall, no. 11,726. See p. 486.

PEDICULARIS LANCEOLATA Michx. To the few known Coastal Plain stations add one in SURRY COUNTY: wooded swamp west of Claremont, no. 12,809. See p. 520.

*JUSTICIA **umbratilis,** sp. nov. (TAB. 693, FIGS. 1–3), *J. humili* simillima; rhizomatibus valde elongatis ramosis 3–7 mm. crassis; caulibus 2–6 dm. altis; foliis oblongo-lanceolatis vel anguste elliptico-oblongis primariis 5–9 cm. longis 1.5–3.5 cm. latis apice basique subacuminatis petiolatis; pedunculis 3.5–10 cm. longis; spicis compactis subcapitatis floribus valde imbricatis 1.5–3 cm. longis; corollis pallide violaceis vel lilacinis 1.5–2 cm. longis, labio superiore recurvato, labii inferioris lobis planis divergentibus oblongis vel ellipticis integris; seminibus brunneis quadrato-rotundatis 2.8–3 mm. longis minute subacuteque rugulosis.—Low dark woods, bottomlands and shaded margins of slow streams and pools, southeastern VIRGINIA: Southampton Co.: bottomland woods along Nottoway River, Monroe Bridge, June 22, 1941, *Fernald & Long*, no. 13,162 (TYPE in Herb. Gray; ISOTYPE in Herb. Phil. Acad.); margin of Nottoway River at Round Gut, south of Franklin, June 12, 1941, *Fernald & Long*, no. 13,162; margin of Nottoway River below Point Beach, south of Franklin, July 20, 1939, *Fernald & Long*, no. 10,820. Nansemond County: muddy tidal margin of Blackwater River, Cox Landing, south of South Quay, September 22, 1939, *Fernald & Long*, no. 11,441. Prince George Co.: "Cat-tail Swamp", river-swamp of Blackwater River, north of Disputanta, June 21, 1936, *Fernald, Long & Smart*, no. 5921. Surry Co.: bottomland woods, Blackwater River, about 1 mile southwest of Dendron, July 14, 1941, *Fernald & Long*, no. 13,159; margin of sluggish stream, Cypress Swamp, near Sexton, June 17, 1941, *Fernald & Long*, no. 13,161. See p. 494.

For six years we have been puzzled by *Justicia umbratilis.* During 1939 and 1940 we became convinced of its distinctness but not until June, 1941, did we have the opportunity to compare side-by-side fresh flowers of *J. umbratilis* and those of *J. americana* (L.) Vahl and of *J. humilis* Michx. (*J. ovata* (Walt.) Lindau, not Dietr.). In its relatively coarse and extensively creeping rhizomes, in its capitate spikes, and in its pebbled seeds without conspicuously differentiated rims *J. umbratilis* is as near to *J. americana* as to *J. humilis,* with which it grows. Its flowers (FIG. 2), however, are, both corolla and

anthers, more like those of *J. humilis* (FIG. 7); for the arched-recurving lower lip of the corolla of *J. americana* (FIGS. 4 and 5) has the central lobe somewhat constricted above the base and the margins are strongly reflexed, the lobes white or whitish-lilac above, the narrow basal shield with brownish-purple and white markings, and the terminal anther is horizontally transverse (FIG. 4), the lower ascending one muticous at both ends. The corollas of *J. umbratilis* and of *J. humilis* are violet to lilac throughout, except that the deltoid shield has a white background, with deep violet margins and spots. Their lower lips (FIGS. 2 and 7) are flat, the margins of the median lobe not reflexed; and the terminal anther is oblique, the lower erect one pointed at base (FIGS. 2 and 7). In texture (firm and opaque) the corolla of *J. umbratilis* (FIG. 2) is like that of *J. americana* (FIGS. 4 and 5), the corolla of *J. humilis* (FIG. 7) being very thin and translucent. In its very prolonged and branching rhizomes *J. umbratilis* suggests the narrower-leaved *J. americana* but these are deep in the mud in *J. umbratilis*, superficial and somewhat coarser in *J. americana*. The seeds of the two are similar but those of *J. americana* (FIG. 6) are drab or pale brown, round-reniform and covered with low and broad flattish pebbling, resembling the pattern of dried and crackled clay. The seeds (FIG. 3) of *J. umbratilis* are deep brown or fulvous, quadrate-orbicular, and covered with very small acutish pebbling.

In its flowers *Justicia umbratilis* is very similar to *J. humilis*, but the corolla is of thicker texture, the lateral lobes of its lower lip wide apart, while the thin-textured corollas of *J. humilis* have the porrect lobes of the lower lip approximate. The latter species (FIGS. 7 and 8), furthermore, has the slender rhizomes less extensively creeping and only 2–4 mm. thick; the stems only 1–3 (rarely –5) dm. high; the leaves more rhombic in outline; the peduncles mostly 1–5 (rarely –8.5) cm. long; the spikes more open, with the flowers becoming scattered or subdistant, the well developed spikes in full anthesis 1.5–5 cm. long; and the more orbicular seeds (FIG. 8) smooth or only faintly and minutely pebbled, with a conspicuous broad and thick entire or merely undulate-dentate rim. *J. umbratilis* has more elongate, more branching and thicker (3–7 mm. thick) rhizomes; usually taller stems (mostly 3–6 dm. high); narrower and scarcely rhombic

leaves; mostly longer peduncles, 3.5–10 cm. long; dense and subcapitate spikes, the crowded flowers closely imbricated, the spikes in full anthesis only 1.5–3 cm. long; seeds quadrate, without distinctly differentiated rim, and the surfaces smooth or with obscure minute pebbling.[1]

In Virginia *Justicia umbratilis* is known only from the southeastern counties, chiefly in dense shade. At the southern margin of its range in the state it associates with *J. humilis*. Since the latter species is highly localized in the state and since its nomenclature is involved, the following paragraphs may be helpful.

J. HUMILIS Michx. Fl. Bor.-Am. i. 8 (1803), photographs of type-sheets in Gray Herb. *Dianthera ovata* Walt. Fl. Carol. 63 (1788). *D. humilis* (Michx.) Gray, Syn. Fl. N. Am. ii[1]. 329 (1878), by Gray and by *Index Kewensis* cited as starting in Engelm. & Gray in Bost. Journ. Nat. Hist. v. 234, repr. as Pl. Lindh. i. 22 (1845), where the mere name was published, without description, bibliographic reference or citation of basinym. *J. ovata* (Walt.) Lindau in Urban, Symbol. Ant. ii. 237 (1900), not Dietr. in Steud. Nom. ed. 2, i. 838 (1840).

The following Virginian specimens of *Justicia humilis* are before me. SOUTHAMPTON COUNTY: wet woods, Assamoosick Swamp, south of Sebrell, no. 10,425; alluvial wooded bottomland of Nottoway River, Cypress Bridge, no. 8466; alluvial woods, bottomland of Mill Creek, Hart's Bridge, no. 8467; about Franklin, *Heller*, no. 987; bottomland woods, Nottoway River,

[1] In studying *Justicia* it has been found desirable to set off a southwestern variety of *J. americana* as

J. AMERICANA (L.) Vahl, var. **subcoriacea**, var. nov., caulibus firmis 2–8 dm. altis pallidis; foliis subcoriaceis pallidis imbricatis oblongis vel lanceolatis vel elliptico-ovatis obtusis vel subacutis, primariis 4.5–15 cm. longis 1–3 cm. latis sessilibus; pedunculis erectis capitulis elevatis.—TEXAS: South Concho River, at Christoval, Tom Green County, June 5, 1934, *Cory*, no. 8860, as *Dianthera ovata* (TYPE in Herb. Gray); Nueces River, 11½ miles south of Uvalde, Zavalla County, October 24, 1934, *Cory*, no. 11,959, as *Dianthera ovata;* bed of small stream, 5 miles south of Fort Worth, June 5, 1912, *A. Ruth*, no. 267, as *D. ovata;* Tarrant County, June 5, 1923, *Ruth*, no. 267; 4 miles northwest of Medina, Bandera County, May 25, 1937, *Cory*, no. 23,530, as *D. ovata;* Cibolo Creek, east of Bulverde, Bexar County, May 2, 1933, *Cory*, no. 6079, as *D. ovata.* OKLAHOMA: edge of creek, Cache, Comache County, June 25, 1913, *G. W. Stevens*, no. 1339, as *D. ovata;* Fort Sill, Comanche County, June, 1916, *Mrs. J. Clemens*, no. 11,781; wet clay, meadow west of Claremore, Rogers County, July 2, 1939, *U. T. Waterfall*, no. 1465. KANSAS: Severy, June, 1905, *S. F. Poole*, no. 133. MISSOURI: Meramec River, *N. M. Glatfelder.*

In typical *Justicia americana* the elongate-lanceolate or -oblanceolate to lance-linear leaves are 0.8–2 dm. long and 0.5–2.5 (rarely –3) cm. broad. After flowering the leafy tip prolongs so that the erect or strongly ascending inflorescences are well overtopped by the leafy tip. In var. *subcoriacea* the firmer and pale leaves are more crowded, broader, shorter and blunter, and the peduncles elevate the flowering heads well above the foliage.

Monroe Bridge, nos. 13,163 and 13,164; wooded bottomland of Blackwater River, southeast of Ivor, no. 13,763. Isle of Wight County: bottomland woods along Blackwater River above Broadwater Bridge, north of Zuni, no. 13,456. Nansemond County: wooded bottomland of Somerton Creek, near Factory Hill, nos. 8468 and 8855. See p. 493.

In plate 693, figs. 1–3 are of Justicia umbratilis: fig. 1, the type, × 2/5; fig. 2, portion of spike, × 3, from *Fernald & Long,* no. 13,159; fig. 3, seed, × 8, from the type. Figs. 4–6, J. americana (L.) Vahl: fig. 4, corolla, × 3, from James River, east of Scotland, Virginia, *Fernald & Long,* no. 13,155; fig. 5, to show shield on middle lobe of lower lip, × 3, from no. 13,155; fig. 6, seed, × 8, from Oneida Lake, New York, *Muenscher,* no. 195. Figs. 7 and 8: J. humilis Michx.: fig. 7, portion of corolla (recurving tip of upper lip covering anthers), × 4½, from Monroe Bridge, Southampton Co., Virginia, *Fernald & Long,* no. 13,164; fig. 8, seed, × 8, from Hart's Bridge, Southampton Co., Virginia, *Fernald & Long,* no. 8467.

Utricularia inflata Walt., var. minor Chapm. (*U. radiata* Small). Southampton County: floating at border of Predler's Pond, Nottoway Swamp, southwest of Sedley, no. 8463.

In Rhodora, xli. 122 (1939) Rossbach stated that the "range of var. *minor* is disrupted, it having been collected from . . . Maine, south near the coast commonly to New Jersey, then becoming very local, if not lacking southward, reappearing in pine barrens of . . . Florida". We have seen it in Virginia only in Predler's Pond, but Mr. Lloyd C. Carr reported it in Claytonia, iv. 24 (1937) from Augusta County; and recent collections from South Carolina and from Delaware, in addition to the Virginian specimens, materially close the implied gap in the known range.

U. vulgaris L. *U. vulgaris,* var. *americana* Gray, Man. ed. 5: 318 (1867); *U. macrorhiza* Le Conte in Ann. Lyc. N. Y. i. 73 (1824). King William County: fresh tidal shore of Mattaponi River, at Horse Landing, near King William Courthouse, no. 11,619. Norfolk County: rills and pools, Great Dismal Swamp, west of Yadkin, no. 11,146.

Utricularia vulgaris, as *U. macrorhiza,* was assigned a range by Barnhart in Britton & Brown, Ill. Fl. ed. 2, iii. 229 (1913): "south to Maryland, Missouri", etc., but in Small, Man. 1236 (1933) Barnhart admitted it as a Virginian but only doubtfully from North Carolina. The Great Dismal Swamp is partly in North Carolina and the plant is presumably in that state.

In the former work he assigned the stems a length of 1–3 feet ("Stems 1°–3° long") and explained his segregation of the

Photo. B. G. Schubert.

Justicia umbratilis: fig. 1, type, × 2/5; fig. 2, flowering spike, × 3; fig. 3, seed, × 8.

J. americana: fig. 4, corolla (dense and opaque), × 3; fig. 5, shield on lower lip and horizontal terminal anther, × 3; fig. 6, seed, × 8.

J. humilis: fig. 7, corolla (translucent), × 3; fig. 8, seed, × 8.

Photo. W. H. Hodge.

UTRICULARIA VULGARIS

Flowers, × ¾–× 1: FIGS. 1 and 2–5 Eurasian; FIGS. 2 and 6–15 North American. Rudimentary stolons, × 1, all (FIGS. 16–19) North American.

American *U. macrorhiza* from the Eurasian *U. vulgaris* as follows. "Very variable, but appears to differ constantly from the related and equally variable European species, *Utricularia vulgaris* L., by the longer stems, the shape and direction of the spur, and the minuteness of the appendages (rudimentary stolons) at the base of the scape".

There is no question that the species is variable, but I match very closely variations of the Eurasian and North American specimens. As to our plant differing, as Barnhart thinks, "by the longer stems", it is significant that in Britton & Brown, l. c., he says of the American "Stems 1°–3° long" and in Small, l. c. "Stems . . . 3–10 dm. long" but that Hegi, Ill. Fl. Mittel-Eu. vi[1]. 168 (1914) should describe the European plant "Sprosse . . . bis 2 m. . . . lang" and that Hugo Glück, who devoted his life to study of hydrophytes, should describe the European plant as "30–200 cm. lang". 200 cm. is the same as 2 m., twice the extreme length given by Barnhart for the American plant with reputedly "longer stems". Glück's longest specimens were collected "bei Viernheim in Hessen",[1] not in North America. As a matter of fact, the maximum length of 3 feet or of 10 dm. given for the American plant could safely have been increased. Our no. 11,146 from the Great Dismal Swamp shows stems 1.2 m. long; so does *Victorin, Rolland & Jacques,* no. 33,854 from New Richmond, Quebec, while a sheet in the herbarium of the New England Botanical Club, collected by Walter Deane from a creek at Gilead, Maine, shows a length of 1.4 m. Even these specimens from North America do not equal the 2 m. recorded by Hegi and by Glück for the European plant, though it is probable that devotion to the task might yield an American specimen as long as the longest European.

The difference in "the shape and direction of the spur" was not defined by Barnhart. From dried material alone the exact form of the corolla is difficult to make out; but the pressed flowers show parallel variations in both Eurasian and North American series. Some of these are shown in PLATE 694, FIGS. 1–15: FIGS. 1 and 3–5 from Eurasian specimens, FIGS. 2 and 6–15 from North American. FIG. 2 shows the flowers (× ¾) of the American plant, as illustrated in Britton & Brown, ed.

[1] Glück, Biol. Morph. Untersuch. Wasser- und Sumpfgew. ii. 30 (1906).

2, iii. fig. 3867, where Barnhart felt that our plant "appears to differ constantly from . . . *U. vulgaris* L. by the . . . shape and direction of the spur"; FIG. 7 is from a painting of the fresh flowers, × ¾, of the American plant (from eastern Massachusetts) by the late Elsie Louise Shaw, whose remarkable series of paintings of native American plants has just been presented to the Gray Herbarium in her name by Julia Howe Shaw; FIG. 1 is copied from the plate of the European plant in Reichenbach's Icones. I am puzzled to see the difference in the spur. So with the other figures, some from Eurasian, some from American specimens, they show great variation on both continents, but the differentiation of even var. *americana* Gray (to say nothing of a purely American species) by a more slender and acutish spur becomes wholly artificial.

As to the occasional production in the Old World series of "rudimentary stolons at the base of the scape", they are sufficiently unusual there as to result in special note of them. The illustration in Britton & Brown to show their "minuteness" in America is indeed minute; but, as Rossbach points out in RHODORA, xli. 118 (1939), they are frequently elongate in North America. In the American specimens before me they are present in 43 numbers and often as long as in the European plants. Some of the American specimens with such prolonged rudimentary stolons at the base of the scape are shown in FIGS. 16–19. As a character distinguishing the American *U. macrorhiza* from the Eurasian *U. vulgaris* the "minuteness" of these structures is no more constant that the other points which have seemed to some botanists besides Barnhart sufficient for specific differentiation of the two. Until those who see two species bring forward a series of stable characters it seems better to treat the variable Eurasian and the equally variable North American plants as a single circumboreal species, *U. vulgaris* L., comparable in its distribution with the circumboreal *U. minor* L. and *U. intermedia* Hayne. Incidentally, the inappropriate name, *U. macrorhiza*, for a free-floating plant will thus sink into synonymy.

In PLATE 694, of details of UTRICULARIA VULGARIS, all figures are × ¾–× 1. FIGS. 1–15, flowers: FIG. 1, from Germany, after *Reichenbach;* FIG. 2, North American, after *Britton & Brown;* FIG. 3, European, after *Hegi;* FIG. 4, from Jalatum, Manchuria, *Dorsett & Dorsett,* no. 3496; FIG. 5, from Irkutsk,

Siberia, *Stubendorff;* FIG. 6, from Woodstock, New Hampshire, *Fernald,* no. 15,570; FIG. 7, from Lexington, Massachusetts, *E. L. Shaw;* FIG. 8, from Norwood, Massachusetts, June 23, 1895, *E. F. Williams;* FIG. 9, from Concord River, Bedford, Massachusetts, August 23, 1884, *C. W. Jenks;* FIG. 10, from Fort Saskatchewan, Alberta, *G. H. Turner,* no. 25; FIG. 11, from Lake Athabasca, Saskatchewan, *Raup,* no. 6624; FIG. 12, from Ann Arbor, Michigan, *F. J. Hermann,* no. 6896; FIG. 13, from Phalanx, Ohio, *A. N. Rood,* no. 64; FIG. 14, from Worcester, Massachusetts, 1890, *G. E. Stone;* FIG. 15, from vicinity of Rosedale, Alberta, *Moodie,* no. 1133. FIGS. 16–19, rudimentary stolons, × 1: FIG. 16, from Round Lake, Wood Buffalo Park, Mackenzie Basin, *Raup,* no. 3142; FIG. 17, from Lake-of-the-Woods, Klamath County, Oregon, *J. W. Thompson,* no. 13,109; FIG. 18, from Lake Athabasca, Saskatchewan, *Raup,* no. 6624; FIG. 19, from Lake James, Steuben County, Indiana, *Deam,* no. 20,241.

U. GEMINISCAPA Benj. To the few recorded stations add one in SUSSEX COUNTY: shallow pond in woods northeast of Homeville, no. 12,187.

OROBANCHE UNIFLORA L. SURRY COUNTY: rich wooded ravines near James River, west of Ingersoll, no. 11,907. See p. 488.

GALIUM PARISIENSE L. To the few recorded stations add one in HENRICO COUNTY: cinders of Chesapeake and Ohio Railroad, west of Elko Station, no. 12,190. See p. 498.

G. CIRCAEZANS Michx., var. HYPOMALACUM Fern. HENRICO COUNTY: rich wooded slopes by James River, west of Varina, no. 12,191.

The upland and inland extreme.

*RICHARDIA BRASILIENSIS (Moq.) Gomez. HENRICO COUNTY: waste places and railroad ballast, Richmond, nos. 12,816–12,818. DINWIDDIE COUNTY: similar habitat, Petersburg, no. 12,481. See pp. 511 and 515.

A South American species becoming naturalized in temperate and tropical North America. Small (Man.) records it only from peninsular Florida, but in southeastern Virginia it has come to stay. Small's differentiation of the two species, *R. brasiliensis* and *R. scabra,* the former as perennial, the latter as annual, is unsatisfactory, for *R. brasiliensis,* though becoming perennial with a deep and thickened root, may fruit the first year. In *R. scabra* the calyx-lobes are united only at base and 3–4 times as long as the ovary, the corolla hypercrateriform, with the lobes much exceeding the stamens, and the cocci of the fruits ventrally sulcate; in *R. brasiliensis* the calyx-lobes are more united and little exceeding the ovary, the corolla infundibuliform, its lobes little exceeding the stamens, and the cocci of the fruits are keeled on the ventral side (these characters derived from Schumann's treatment in Flora Brasiliensis).

Besides the Virginian material the following specimens of *Richardia brasiliensis* are in the Gray Herbarium from north of Florida.

North Carolina: sandy roadside bank 1 mile east of Delco, Columbus Co., July 5, 1927, *Wiegand & Manning*, no. 3015; dry sandy soil, waste ground, 2 miles south of Wilmington, July 25, 1922, *L. F. & F. R. Randolph*, no. 1007; roadside near Wilmington, *Godfrey & Shunk*, no. 4221. South Carolina: sandy roadside bank, 1 mile west of Marion, Marion Co., *Wiegand & Manning*, no. 3013; roadside gravel, 10 miles northwest of Charleston, *Godfrey & Tryon*, no. 702; damp sandy roadside, 3 miles southeast of Waterboro, Colleton Co., *Wiegand & Manning*, no. 3016.

There are also specimens from Alabama and Texas.

*Diodia teres Walt., var. **oblongifolia,** var. nov., a var. *typica* differt caulibus valde depressis; foliis oblongis vel oblongo-ellipticis 1–2.5 cm. longis 5–8 mm. latis; stipulis vix fructibus aequantibus; fructibus 3–3.5 mm. longis valde hispidis, pilis divergentibus.—Southeastern Virginia: disturbed white sand of dry woods and clearings east of Joyner's Bridge, Isle of Wight County, July 17, 1940, *Fernald & Long*, no. 12,480; dry sandy roadside at crossing of Southern Railroad, Lee's Mill, Isle of Wight County, August 24, 1936, *Fernald & Long*, no. 6698; disturbed white sand of dry pine barrens, south of Lee's Mill, July 11, 1940, *Fernald & Long*, no. 12,479; same locality, August 23 and September 2, 1940, *Fernald & Long*, no. 12,820 (type in Herb. Gray, isotype in Herb. Phil. Acad.); waste ground, Franklin, September 11, 1941, *Fernald & Long*, no. 13,767; railroad ballast, Richmond, Fredericksburg and Potomac Railroad, Richmond, August 19, 1940, *Fernald & Long*, no. 12,819. See pp. 508 and 514.

Var. *oblongifolia* is at once recognized by its oblong and broad-based leaves, by its relatively short stipules and by the spreading-hispid fruit. In the latter and in its foliage it approaches var. *hystricina* Fernald & Griscom in Rhodora, xxxix. 307, t. 469, figs. 2 and 3 (1937), but var. *hystricina* has strongly hispid or hirsute stems, narrower and more elongate leaves (when well developed 1.5–4.5 cm. long), the more densely hispid fruit 3.8–5 mm. long. Var. *oblongifolia* has puberulent stems, short and broad leaves only 1–2.5 cm. long, and short-hispid fruits only 3–3.5 mm. long. Typical *D. teres* is usually not depressed and it has linear to linear-lanceolate and elongate leaves and the bristles of the stipules greatly overtop the fruits.

VIBURNUM **recognitum,** nom. nov. *V. dentatum* L., *α. lucidum* Ait. Hort. Kew. i. 372 (1789), not *V. lucidum* Mill. Gard. Dict. ed. 8, no. 5 (1768). *V. dentatum* sensu most authors, not L. Sp. Pl. 268 (1753) nor Svenson in RHODORA, xlii. 5, pl. 586 (1940).

Viburnum dentatum L. and *V. pubescens* (Ait.) Pursh have been much discussed in recent years, first by Blake,[1] later by Svenson.[2] It is, therefore, tedious at least to continue the discussion. I fully concur in Blake's decision that the type of *V. pubescens* (Ait.) Pursh belongs in the more southern series with usually pubescent branchlets, including *V. venosum* Britton; I also agree, from Svenson's notes upon and photograph of the type of *V. dentatum* L., that it has long been misinterpreted (or not examined) and that it is inseparable from *V. venosum*, var. *Canbyi* Rehder.

I am not prepared, however, to follow Svenson in reducing to the variable and usually pubescent *V. dentatum* (= *V. venosum*) merely as a glabrous-twigged variety the usually more northern shrub which has regularly passed as *V. dentatum*, i. e. *V. dentatum α. lucidum* Ait. The two species, true *V. dentatum* L. (including *V. pubescens* (Ait.) Pursh, *V. scabrellum* (T. & G.) Chapm., *V. venosum* Britton, *V. longifolium* Loddiges ex Zabel and *V. semitomentosum* (Michx.) Rehder) and *V. recognitum* (*V. dentatum*, *α. lucidum* Ait.) are both hopelessly variable in leaf-outline and toothing of leaves, each of them with blades varying from lance-ovate or ovate-oblong to orbicular, with veins prominent beneath or obscure, with length from 2.5 to 10 cm. and breadth from 2 to 8 cm. In the series with usually pubescent new branchlets and more or less pubescent leaf-surfaces and inflorescences these different leaf-outlines have formed the bases for several so-called species and varieties; in *V. recognitum* exactly parallel leaf-variations have been quite as consistently ignored. The type of *V. dentatum* can be easily matched in shape, size and toothing of leaf by many sheets of unquestioned *V. recognitum*. The type of Michaux's *V. dentatum β. semitomentosum* from South Carolina, basis of *V. semitomentosum* (Michx.) Rehder, is closely matched in leaf-outline by some extreme (elongate-leaved) specimens of *V. venosum*

[1] S. F. Blake, *On the Names of some Species of Viburnum*, RHODORA, xx. 11–15 (1918).

[2] H. K. Svenson, *Plants of Southern United States, I. Viburnum dentatum*, RHODORA, xlii. 1–6 (1940).

from southeastern Massachusetts, by authentic material of *V. dentatum β. scabrellum* T. & G. or *V. scabrellum* (T. & G.) Chapm., by some of Canby's material of *V. pubescens* var. *Canbyi* (Rehder) Blake, as well as by authentic sheets of *V. pubescens* var. *indianense* Rehder. In other words, most of these reputed varieties, dependant for their recognition upon evasive degrees of pubescence and leaf-outline, are scarcely to be accorded true varietal rank; at best they are rather trivial forms. And even the most extreme of these variations in leaf-outline can be fairly matched in the more glabrous *V. recognitum,* in which, as noted, no varieties have been thought worthy recognition by our students of trees and shrubs.

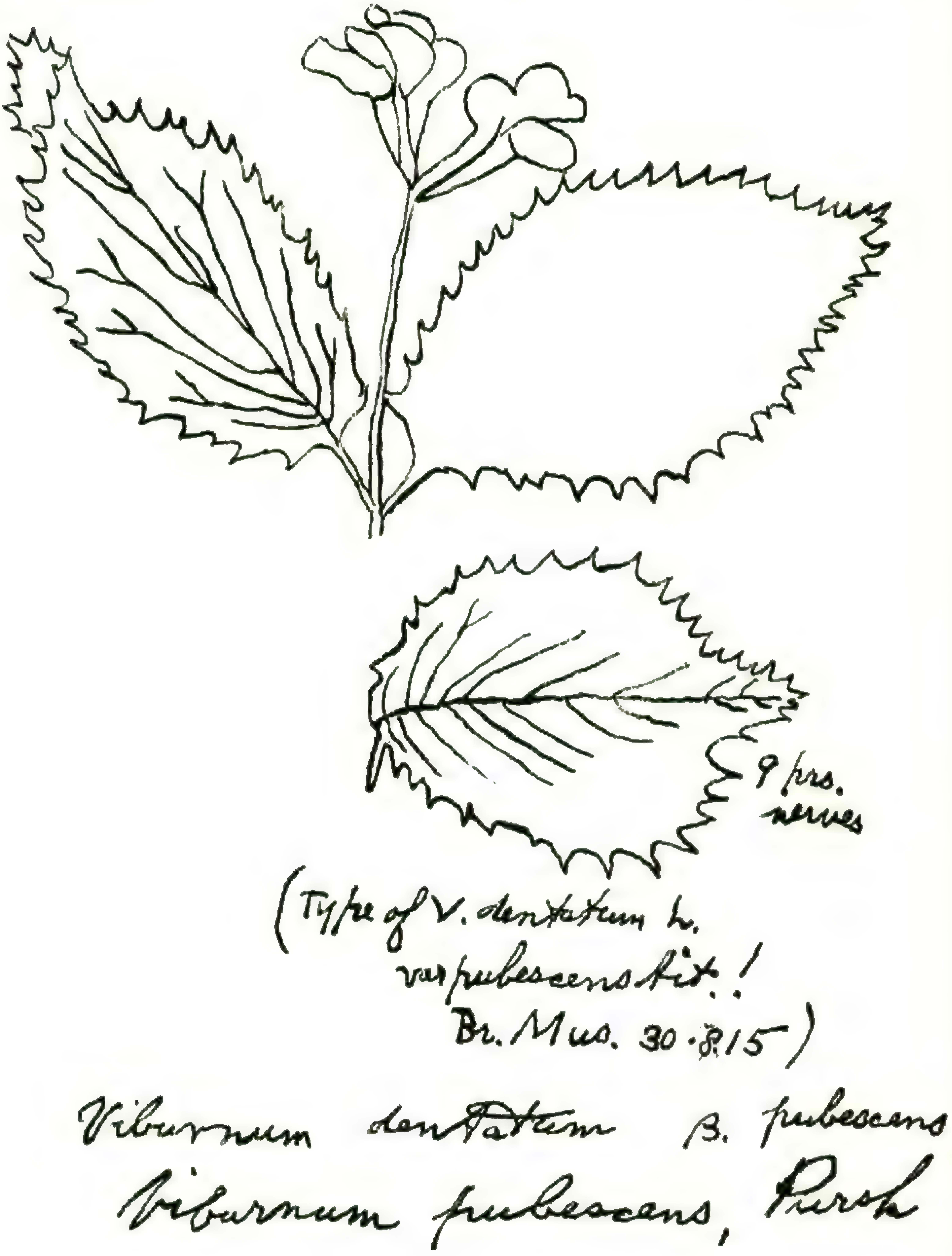
The strongest departure from the regular run of leaf-variation in *Viburnum dentatum* which I see is in the type of *V. dentatum β. pubescens* Ait., therefore of *V. pubescens* (Ait.) Pursh. This type was traced by Blake in 1915 and his tracing (see p. 650) is preserved in the Gray Herbarium. It is, therefore, somewhat perplexing to find him, in 1918, writing that "The type of *β. pubescens,* marked 'Hort. Dr. Lee,' and labeled in Solander's own hand, is a characteristic specimen of the plant now passing as *V. venosum* Britton"; and then recognizing, in his summary, not only "Viburnum pubescens (Ait.) Pursh.—*V. venosum* Britton" but, likewise, "V. pubescens (Ait.) Pursh var. **longifolium** (Dippel).—*V. dentatum* var. *longifolium* Dippel . . . *V. venosum* var. *longifolium* (Dippel) Rehder". The .perplexity arises through the fact that *V. dentatum β. pubescens* Ait. was originally accurately described "foliis ovato-oblongis acuminatis subtus villosis, petiolis elongatis", while *V. venosum* Britton was originally and correctly described with "blades broadly ovate to orbicular"; and Britton correctly so illustrated the most typical leaf-outline of his own *V. venosum* in Ill. Fl. iii. 272 (1913). I have counted the commonly broad and deltoid (though sometimes prolonged) teeth on the leaf-margins of all the plastic forms of *V. dentatum* and *V. recognitum.* They range from 4–18 (very rarely to 22) on each side of the midrib. The tracing of Aiton's type of *V. dentatum* var. *pubescens* made by Blake shows ovate-oblong leaves with 16–22 *lance-falcate* teeth. It is closely matched by authentic material of *V. dentatum* var. *longifolium* Dippel or *V. venosum* var. *longifolium* (Dippel) Rehder or *V.*

pubescens var. *longifolium* (Dippel) Blake, this variety being a shrub long cultivated in Europe, whence it was received at the Arnold Arboretum. Rehder, Man. Cult. Trees and Shrubs, ed. 2: 841 (1940) correctly describes it with "Lvs. narrower and longer, usually ovate-oblong." The type of *V. pubescens* (*V. dentatum* *β. pubescens* Ait.) was also correctly described "foliis ovato-oblongis", and Blake's tracing of it is closely matched by material from the Arnold Arboretum of *V. dentatum* var. *longifolium* Dippel, not only in leaf-outline but in the very numerous, slender and falcate teeth. That var. *longifolium* is the same as typical var. *pubescens* Ait., also described from material in European gardens, I am satisfied.

Besides *Viburnum dentatum,* var. *pubescens* Ait. (known primarily in cultivation) the only variation within the species which seems to me worthy recognition as a geographic variety is the inland extreme with glabrous or nearly glabrous branchlets, the petioles often with subpersistent basal stipules, whereas the highly variable but confluent series with pubescent branchlets very rarely shows stipules. This extreme is

V. DENTATUM L., var. **Deamii** (Rehder), comb. nov. *V. pubescens,* var. *Deamii* Rehder in Journ. Arn. Arb. v. 58 (1924) and var. *indianense* Rehder, l. c. 59 (1924).

These varieties proposed by Rehder, *V. pubescens,* vars. *Deamii* and *indianense,* show less difference than do *V. venosum* Britton and *V. venosum,* var. *Canbyi* Rehder, which, as I have seen them in the field, are edaphic phases of a single shrub, the extreme in more exposed habitats having thick, sulcate-ribbed and strongly pubescent leaves, the extreme in more protected spots having thinner, flatter and less pubescent blades. The keen observer, C. C. Deam, who had collected the original material of both of Rehder's proposed varieties, wrote, in 1924, of var. *indianense:* "This shrub very much resembles the preceding [var. *Deamii*], from which it is sometimes very doubtfully separated. For this reason, the writer believes that a further study of the two shrubs will show that this is only a form of the preceding"—Deam, Shrubs of Indiana, 321 (1924). After "further study", in 1932, Deam, in his 2nd edition (p. 350), seems not to have altered his opinion.


9 prs. nerves
(Type of V. dentatum L. var pubescens Ait.!
Br. Mus. 30·8·15)
Viburnum dentatum β. pubescens
Viburnum pubescens, Pursh

That *Viburnum recognitum* is *V. dentatum* α. *lucidum* Ait. there is no doubt but, since there is already a *V. lucidum*, Aiton's name can not be taken up. It is not improbable that it is also *V. dentatum* α. *glabellum* Michx. Fl. Bor.-Am. i. 179 (1803). My photograph of the latter, taken in 1903, looks like it but, because there is already an American *V. glabratum* HBK. (*V. glabrum* Willd. ex Schultes) it is wiser not to make confusion by taking up Michaux's varietal name for a species.

As pointed out by Mr. Bayard Long in Stone's Plants of Southern New Jersey, 709, the flowering and fruiting periods in the same region of *V. dentatum* true (*V. scabrellum*, etc.) and of *V. recognitum* ("*V. dentatum*" of authors, not L.) are very different. The shrub with pubescent branchlets, foliage and cyme flowers in southern New Jersey from "Mid-June to early July" and its fruits are mature from "Early September to early October". In the same region *V. recognitum*, with glabrous branchlets and cyme and glabrous or glabrate foliage, flowers from "Late May to mid-June", the fruit maturing from "Early August to early September". On Nantucket Island, the type region of *V. venosum* Britton, Bicknell recorded[1] the glabrous *V. recognitum* (*V. dentatum* of Bicknell) as "just in flower June 22, . . . no flowers remaining July 12", but the pubescent *V. dentatum* (*V. venosum*) with "forward bushes just in flower June 30 . . . , everywhere in showy bloom July 4 to 13". Similarly on Cape Cod and Martha's Vineyard, the very large representation of the two in the herbarium of the New England Botanical Club gives the following: V. DENTATUM (*venosum*), flowers June 28–August 14, ripe fruit August 26–November 1; V. RECOGNITUM, flowers June 16–July 5, ripe fruit August 6–September 19. Throughout their coincident ranges, then, *V. dentatum* (*venosum*) is in prime of flowering 10 days to 3 weeks later than *V. recognitum;* while the former matures its fruit 3 to 4 weeks later. The ripe drupes of *V. dentatum* range from 5–8 mm. long; those of *V. recognitum* are slightly but not strikingly smaller (5–7 mm.). Ordinarily the stones of *V. dentatum* are ellipsoid-ovoid, those of *V. recognitum* more globose-ovoid; and the ventral groove of the stone in the former is narrow, deep and furrow-like, in the latter broader, shallow and trough-like.

[1] E. P. Bicknell, Bull. Torr. Bot. Cl. xlii. 347, 348 (1915).

V. dentatum is a southern species, occurring from Florida to Texas, north to southeastern Massachusetts, Block Island (Rhode Island), Long Island, New Jersey, Pennsylvania, West Virginia, southern Ohio, central Indiana and Missouri. *V. recognitum* is more northern: New Brunswick to southern Ontario, south to South Carolina (or Georgia), northern Ohio and Michigan.

*V. nudum L., var. angustifolium Torr. & Gray. York County: wooded swamp along Carter's Creek, about 8 miles north of Williamsburg, *Grimes*, no. 3589. Southampton County: depression in sandy pine woods north of Point Beach, south of Franklin, no. 13,166; rich woods in ravine of small brook south of Applewhite's Church, no. 13,167.

Viburnum nudum, in its typical development, is a coarse, often tree-like shrub with the mature leaves of the fertile branches elliptic to narrowly ovate or obovate and 6–15 cm. long, by 2.5–7.5 cm. broad, the cymes 7–10 cm. broad. It extends northward to southern Connecticut, Kentucky and Arkansas. Var. *angustifolium* is lower, the mature leaves of the fertile branches lanceolate to narrowly oblong and 3.5–10 cm. long, by 1.7–3 cm. broad, its cymes only 2.5–7 cm. broad. It occurs in bogs, savannahs and wet woods from Florida and Alabama to southeastern Virginia. The Grimes material belongs in the variety but not in its more extreme development. Our no. 13,166 is more characteristic.

*Sambucus nigra L. Dinwiddie County: waste ground, Petersburg, no. 12,486. See p. 511.

The European species, here probably spread from cultivation.

Campanula aparinoides Pursh. Sussex County: wooded springhead by Nottoway River, south of Chub, no. 12,484.

Our first Coastal Plain station in the state. See p. 507.

C. americana L. Range extended down the James to Isle of Wight County (several nos.). See p. 520 and map 7.

Lobelia siphilitica L. Range extended down the James to Isle of Wight County (several nos.). See p. 520.

*Vernonia glauca (L.) Willd., forma **longiaristata,** f. nov., phyllaribus longe aristatis, aristis 4–6 mm. longis.—Occasional in range of typical *V. glauca*. New Jersey: loamy, wooded slope, west of Chestnut Branch of Mantua Creek, Sewell, Gloucester County, September 22, 1920, *Long*, no. 23,399. Virginia:

rich calcareous wooded ravine west of Claremont, Surry County, August 28, 1940, *Fernald & Long*, no. 12,836 (TYPE in Herb. Gray; ISOTYPE in Herb. Phil. Acad.); rich wooded slope just above the "fall-line" by Three Creek, northwest of Emporia, Surry County, August 17, 1940, *Fernald & Long*, no. 12,835. NORTH CAROLINA: rocky woodland, Oxford, Granville County, July 28, 1938, *Godfrey*, no. 5521; thicket near Siler City, Chatham County, October 14, 1938, *Godfrey*, no. 6975.

Typical *V. glauca*, as shown by heads of the Clayton plant given to Asa Gray in 1839, the only material cited by Linnaeus under his *Serratula glauca* which he had actually studied, has the broad phyllaries barely tipped by short awns. It is from characteristic material of the plant now generally known as *V. glauca*, in which the awns vary from none on some phyllaries up to 4 mm. long. Forma *longiaristata*, growing in rich woodlands with typical *V. glauca* or in colonies by itself, simulates *V. noveboracensis* of more peaty habitats in its involucre but in its foliage and pale brownish pappus is good *V. glauca*.

EUPATORIUM ALTISSIMUM L. ISLE OF WIGHT COUNTY: rich calcareous wooded slopes by Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), no. 12,848; seeping argillaceous and calcareous bluffs near Rushmere, no. 12,849.

Our first evidence of this inland and upland species on the Coastal Plain. See p. 525.

E. SESSILIFOLIUM L. SURRY COUNTY: thicket back of sand-beach of Cobham Bay, James River, northwest of Chippokes, no. 12,851.

As in the preceding, our first Coastal Plain station. See p. 521.

E. SESSILIFOLIUM, var. VASEYI (Porter) Fernald & Griscom. Local range extended northward. CHESTERFIELD COUNTY: thicket south of Dutch Gap, no. 12,852. HENRICO COUNTY: open thickets, South Richmond, no. 12,853.

E. INCARNATUM Walt. SURRY COUNTY: rich calcareous wooded ravine west of Claremont, no. 12,856. PRINCESS ANNE COUNTY: rare, Munden, September, 1905, *Mackenzie*, no. 1773. See p. 520.

Although long ago reported from Virginia, the two nos. above cited are all that have come to the Gray Herbarium. The corollas are a pale lilac, not of the deeper color we had expected.

SOLIDAGO GIGANTEA Ait., var. LEIOPHYLLA Fernald. SUSSEX COUNTY: rich woods by Nottoway River, southeast of Stony Creek, no. 12,488.

Our first Coastal Plain station. See p. 509.

*Aster laevis L., forma **amplifolius** (Porter), stat. nov. *A. laevis*, var. *latifolia* Porter in Bull. Torr. Bot. Cl. xxi. 121 (1894), not *A. latifolius* Desf. (1829). *A. laevis amplifolius* Porter in Mem. Torr. Bot. Cl. v. 324 (1894).

Our Virginian material is from Isle of Wight County: seeping argillaceous and calcareous bluffs along Burwell's Bay, James River, near Rushmere (Fergusson's Wharf), no. 12,865, some of the obtuse and oblong-elliptical rosette-leaves abruptly contracted at base, the blades up to 6 cm. broad.

A. infirmus Michx. Local range extended into Surry County: rich calcareous wooded ravines west of Claremont, no. 12,868. See p. 520.

A. tenuifolius L. Extending up the James to Surry County: fresh to brackish tidal marshes, Hog Island, no. 12,866.

*Erigeron quercifolius Lam. Henrico County: freight-yard of Atlantic Coast Line Railroad, Richmond, no. 12,869.

Extension north from North Carolina. See p. 516.

*Erigeron **scaturicola,** sp. nov. (tab. 695, fig. 1 et 2), perennis caudice plus minusve multicipito; foliis basilaribus rosulatis carnosis obovatis subintegris vel undulato-dentatis late petiolatis 0.5–3 dm. longis 2–12 cm. latis; caulis laxe adscendentibus vel suberectis mollibus (1–)3–8 dm. altis basi villosis supra glabrescentibus laxe corymboso-ramosis; foliis caulinis carnosis obovatis vel late oblongis vel ovatis integris vel parce dentatis glabris vel glabratis imis basi plerumque contractis, mediis superioribusque basi late rotundatis vel subamplexicaulibus 1.5–6 cm. latis; corymbis laxe ramosis, capitulis junioribus erectis longe pedunculatis; involucris hemisphericis, phyllaribus lineari-oblongis acutis viridibus albido-marginatis 5–8 mm. longis glabris vel dorso sparse setosis; ligulis numerosissimis albidis phyllaribus duplo longioribus; acheniis lineari-columnaribus vel lineari-oblanceolatis olivaceis 1 mm. longis glabris vel strigosis glabratisque; receptaculi denudati foveis quam jugis latioribus.—Seeping and springy calcareous marl-bluffs and adjacent beaches of the James River, Isle of Wight and Surry Counties, Virginia: Isle of Wight County: seeping argillaceous and calcareous bluffs along Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), August 27 and 29, 1940, *Fernald & Long*, nos. 12,870 and 12,871; under crest of seeping calcareous bluff of James River, below Fort Boykin, June 14, 1941, no. 13,179; thickets and open woods back of beach of James River, west of Fort Boykin, June 14, 1941, no. 13,180; steep bushy calcareous bluff below Fort Boykin, June 14, 1941, no. 13,178; seeping calcareous wooded bluff west of Fort Boykin, June 14 and 16, 1941, no.

Photo. B. G. Schubert.

Erigeron scaturicola: fig. 1, two small plants, × 2/5, showing characteristic elongate caudex; fig. 2, portion of denuded receptacle, × 9.
E. philadelphicus: fig. 3, denuded receptacle, × 9.

13,181 (TYPE in Herb. Gray; ISOTYPE in Herb. Phil. Acad.) and no. 13,182. Surry County: base of seeping calcareous wooded slope by James River, below Sunken Meadow Beach, June 16, 1941, no. 13,183; seeping calcareous and argillaceous bluffs along James River, Claremont, September 7, 1941, *Fernald & Long*, no. 13,822.

Erigeron scaturicola (from *scaturex*, a gushing spring) is apparently a local ally of the wide-ranging *E. philadelphicus* L. of meadows, damp shores and thickets across the continent, a species represented in tidewater Virginia in only a few meadows and damp woodlands of Surry and Princess Anne Counties. *E. philadelphicus* is a short-lived perennial or biennial without strongly developed caudices; *E. scaturicola* a deep-rooted perennial with stout branching rhizome and elongate caudices. The leaves of *E. philadelphicus* are relatively narrow, scarcely or rarely amplexicaul, villous and of submembranaceous texture; the glabrous or glabrate leaves of *E. scaturicola* are fleshy and brittle, those of the basal rosettes much larger than in *E. philadelphicus*, the middle and upper cauline ones subamplexicaul and large, the bracteal ones much broader than in *E. philadelphicus*. In *E. philadelphicus* the usually single erect stems terminate in regular corymbs with the young and unexpanded heads nodding. In *E. scaturicola* the loosely ascending, arching or sometimes erect stems fork down to or below the middle into a loose inflorescence, with the young peduncles ascending, not nodding. The involucre of *E. philadelphicus* is commonly villous, that of *E. scaturicola* glabrous or nearly so. The ligules of *E. philadelphicus* are flesh-pink to deep-lilac (white in rare forms) and 2–3 times the length of the phyllaries. The achenes of the two species are similar but usually glabrous or more promptly glabrate in *E. scaturicola*. The denuded receptacles, after the falling of the achenes are somewhat different. In *E. philadelphicus* the pits of the receptacle (FIG. 3) are minute, with a subulate projection (the stipe of the disarticulated flower), and the separating ridges are broader than the pits; in *E. scaturicola* the broad and shallow pits (FIG. 2) show no subulate projections and are broader than the separating ridges.

So far as we yet know *Erigeron scaturicola* is confined to the dripping or seeping spring-fed bluffs (and adjacent thickets and

beaches below the bluffs) of soft and pasty Miocene fossiliferous marls along the lower James River in Isle of Wight and Surry Counties. Where the Miocene beds are solidified (as at Scotland Ferry, for instance) there is no trace of it. In the region of its best development, from Burwell's Bay (Fergusson's Wharf) near Rushmere to the rapidly collapsing bluffs below Old Fort Boykin, it is associated with a considerable flora of localized species with disrupted ranges. Late in the season the old flowering stems may lop over into the dripping marl and clay and there form new rosettes and flowering stems from the axils of the fallen leaves (our no. 12,871). See p. 524.

In plate 695, fig. 1 is two small plants, × 2/5, of Erigeron scaturicola from the type-number; fig. 2, portion of denuded receptacle, × 9, from type. Fig. 3 is a denuded receptacle of E. philadelphicus L., × 9, from Hanover, New Hampshire, July 6, 1910, *E. F. Williams*.

Gnaphalium spathulatum Lam. To the single recorded station (in Henrico County) add one in Dinwiddie County: waste ground and cinders of freight-yard of Atlantic Coast Line, Petersburg, no. 12,491. See p. 511.

Silphium compositum Michx. Local range extended eastward into Nansemond County: dry sandy pineland southwest of Marsh Hill School, south of South Quay, nos. 12,878 and 12,879.

No. 12,878 is quite like a photograph of Michaux's type of *S. compositum*, which was clearly described "foliis radicalibus trifoliatis; foliolis petiolatis, inaequaliter sinuato-multipartitis". This is one of the extremes of the species and it was separated by Small as *S. lapsuum* Small.

*Rudbeckia spathulata Michx. Greensville County: margin of low woods southeast of Emporia, no. 11,195 (distrib. as *R. fulgida*).

The first from north of North Carolina, unless a specimen so identified (but inadequate for study), from Augusta County, *Carr*, no. 808, belongs here. The Virginia plant called by Gray *R. spathulata*, in preparing his treatment for the Synoptical Flora, belongs to *R. umbrosa*, occurring from the Blue Ridge and the Alleghenies to the Ozark region. This specimen is

*R. umbrosa Boynton & Beadle. Bedford County: October 1, 1871, *A. H. Curtis* (as *R. fulgida*).

The three species here involved are separated by the following characters.

Basal and lower cauline leaves ovate, broadly rounded to subcordate at base, 3.5–5 cm. broad; ligules 1.5–3 cm. long. *R. umbrosa.*

Basal and lower cauline leaves lanceolate or oblanceolate to narrowly obovate or narrowly elliptic, gradually tapering at base, 0.5–4.5 cm. broad; ligules 1–2 cm. long.

Middle and upper internodes and bases of leaves spreading-hirsute; basal and petioled cauline leaves 2–4.5 cm. broad; involucre 1–2.2 cm. long, its larger phyllaries 2.5–7 mm. broad .... *R. fulgida.*

Middle and upper internodes glabrous to strigose-hispid; bases of leaves appressed-short-strigose; basal and petioled cauline leaves 0.5–2 cm. broad; involucre 5–9 mm. long, its larger phyllaries 1–2 mm. broad .... *R. spathulata.*

R. TRILOBA L. Range extended down the James to ISLE OF WIGHT COUNTY: thicket back of sand-beach of Burwell's Bay, below Rushmere (Fergusson's Wharf), no. 12,883.

HELIANTHUS MOLLIS Lam. To the few recorded stations add one in HENRICO COUNTY: thickets and borders of woods, Richmond, no. 12,884.

H. DECAPETALUS L. Range extended down the James to ISLE OF WIGHT COUNTY: (several nos.).

*COSMOS SULPHUREUS Cav. ISLE OF WIGHT COUNTY: roadsides and waste places, Rushmere (Fergusson's Wharf), no. 12,889. DINWIDDIE COUNTY: roadsides and waste places, Petersburg, no. 13,831.

A garden plant, likely to become more common as an escape.

*ANTHEMIS SECUNDIRAMEA Bivona. HENRICO COUNTY: waste places and railroad ballast, Richmond, no. 12,500.

A short-rayed species from the Mediterranean. See p. 516.

*SENECIO CRAWFORDII Britton. SURRY COUNTY: bottoms of rich calcareous wooded ravines west of Claremont, no. 12,892, very local. See p. 521.

First from south of Prince George County, Maryland.

*LACTUCA HIRSUTA Muhl., var. SANGUINEA (Bigel.) Fernald, forma **indivisa,** f. nov., foliis caulinis oblongis vel subrotundatis remote dentatis nec lobatis. VIRGINIA: low woods and thickets near Hunting Quarter Creek, southwest of Lumberton, Sussex County, July 10, 1940, *Fernald & Long* (TYPE in Herb. Gray).

NOTES ON MISSOURI PLANTS

Julian A. Steyermark

All specimens representing the plants discussed below may be found in the Herbarium of the Field Museum of Natural History.

Scirpus Torreyi Olney. Represented by *Steyermark 27146*, around deep part of margin of upland sink-hole pond along highway 32, sect. 6, 1¼ mi. north of Lynchburg, Laclede Co., June 23, 1939.

This adds another to the list of relic plants from the northern and northeastern parts of the United States isolated in and around these upland sink-hole ponds. Besides this species, *Najas gracillima* (A. Br.) Morong, *Glyceria acutiflora* Torr., and *Carex decomposita* Muhl. are restricted in Missouri to such ponds. The slender weak rootstock, obtusely 3-angled culms, nodulose leaves fibrillose at base, blunt involucral leaf, oblong or spindle-shaped spikelets, smooth barely mucronate scales, and 3-cleft styles distinguish this species easily from *S. americanus.*

Scirpus heterochaetus Chase. The following collections, determined by Mr. Allan A. Beetle who is monographing this group of species, are from Missouri: *George Moore*, Wire Road, Laclede Co., July 12, 1937; *Steyermark 23292*, margin of upland pond, 3½ mi. south of Licking, Texas Co., July 15, 1937.

Carex microdonta Torr. & Hook. Previously known from wet prairies in Kansas, Oklahoma, Mississippi, and Texas, this species was recently collected by the writer in Missouri: *Steyermark 27682*, limestone glade on top of southwest-facing bluffs along Big Maries River, T 42 N, R 10 W, sect. 24 and 25, 5 mi. northwest of Freeburg, Osage Co., July 1, 1939. This specimen has been determined by Dr. F. J. Hermann.

Carex subimpressa Clokey, Rhodora **21:** 84. 1919. The type of this species was collected in Macon Co., Illinois; it has also been found in Indiana. This is its first known record from Missouri: *Steyermark 26489*, in swamp in alluvial bottoms of Mississippi River along highway 61, 2 mi. north of Canton, Lewis Co., May 14, 1939. This collection has been determined by Dr. F. J. Hermann.

This species, which is considered a hybrid between *Carex lanuginosa* and *Carex hyalinolepis*, was growing in dense colonies with one of its parent species, *C. lanuginosa* (*Steyermark 26490*) and with *C. vesicaria* (*Steyermark 26489a*). Although no collections of the other supposed parent (*C. hyalinolepis*) were

taken from this area, it probably occurs in the near vicinity. The hybrid plants had creeping rootstocks, grass-green leaves with glabrous sheaths, hairy perigynia, and prominent teeth of the perigynium-beak. The plants in general were more robust than *C. lanuginosa* but less so than *C. hyalinolepis* or *C. vesicaria*.

Carex virescens Muhl. In the "Annotated Catalogue of the Flowering Plants of Missouri" by E. J. Palmer and the writer *Carex virescens* Muhl. was recorded from Scott, Dunklin, Butler, and Ripley counties. These records refer and should be transferred, however, to what is now called *Carex Swanii* (Fern.) Mack., in Bull. Torr. Bot. Club **37:** 246. 1910 and N. Am. Fl. 18^6: 321. 1935, and based upon *Carex virescens* var. *Swanii* Fern., since all the collections mentioned in these counties have the subglobose to thick-cylindric spikes 3–5 mm. thick and with less strongly ribbed perigynia characteristic of *Carex Swanii*.

In Mackenzie's treatment of Carex in N. Am. Fl. $\mathbf{18^6}$: 321–322. 1935, *Carex virescens* Muhl. is shown as occurring west to Indiana, Ohio, Kentucky, and Tennessee. A recent collection by the writer from Missouri, and verified by Dr. F. J. Hermann, shows that its range extends west of the Mississippi River. This Missouri collection is represented by *Steyermark 27161*, shaded north-facing sandstone ledges along Jack's Fork of Current River, from ½ mile of Shannon Co. line to near Shannon Co. line, T 28 N, sect. 36, 5½ mi. southeast of Arroll, Texas Co., June 23, 1939. This collection has the linear-cylindric spikes, costate perigynia, and other characters of typical *C. virescens*, a species of the more northern and northeastern parts of the United States.

Tradescantia Tharpii Anderson & Woodson × T. canaliculata Raf. This hybrid has not previously been noted, either by the writer or in Anderson and Woodson's studies of Tradescantia. It is represented from Missouri by the following collection: *Steyermark 22224*, limestone glade along Johnson Creek, T 29 N, R 26 W, sect. 36, ½–2½ mi. southwest of Spencer, 6–7 mi. west of Halltown, Lawrence Co., May 6, 1939.

Both of the parent species occurred on this glade. The plant collected had the glaucous appearance of *T. canaliculata*, but the low stature and pubescence of *T. Tharpii*.

JUNCUS KANSANUS Hermann. Originally described from Kansas by Hermann in Papers Mich. Acad. Sci. **20:** 41. 1935, it was collected about twenty-five years ago from Pike County, Missouri, by Reverend *John Davis*, and this collection has been its only record from the state. Recently, the writer found this species in the western part of the state nearer the Kansas area, and this collection, verified by Dr. F. J. Hermann, is represented by the following: *Steyermark 27508*, upland sandstone glades, T 36 N, R 26 W, sect. 36, 2 mi. southwest of Birdsong, St. Clair Co., June 27, 1939.

The short congested inflorescence, the ascending perianth-segments, completely 3-celled capsules, bract longer than the inflorescence, and the firm membranaceous auricles which are slightly produced, distinctly mark this species.

SISYRINCHIUM CAMPESTRE Bicknell, forma **kansanum** (Bicknell), comb. nov.—*S. campestre* Bicknell, var. *kansanum* Bicknell, Bull. Torr. Bot. Club **26:** 344. 1899.

The white-flowered *Sisyrinchium campestre* var. *kansanum* Bicknell appears to have no differentiating characters other than corolla-color and seems best treated as a form.

SISYRINCHIUM CAMPESTRE Bicknell, forma **flaviflorum** (Bicknell), comb. nov.—*S. flaviflorum* Bicknell, Bull. Torr. Bot. Club **26:** 345. 1899.

This yellow-flowered variation also may be considered as worthy only of formal status.

On page 92 of my Spring Flora of Missouri, both of the above combinations were given by mistake, but due to an oversight by the printer, the writer, away on an extended trip, did not have the opportunity of correcting the error in time. In order that these combinations may have a legitimate status, they are given above in their desired form with complete bibliographical data.

POPULUS DELTOIDES Marsh., f. **pilosa** (Sarg.) Palmer & Steyermark, comb. nov. *P. balsamifera* var. *pilosa* Sarg. Journ. Arnold Arb. **1:** 63. 1919. *P. deltoides pilosa* (Sarg.) Sudw. Check List Forest Trees U. S. 65. 1927. This rare hairy-leaved form has been, until recently, collected in Missouri but once, that in Dunklin County. Recently, the writer collected it in the Ozark region, at the second station known in the state, as represented by the following collection: *Steyermark 26530*, in back of gravel bar along Middle Fork of Black River, just west of Lesterville, Reynolds Co., May 21, 1939.

This collection has the petioles as well as the leaf-surface hairy.

Silene stellata (L.) Ait. f., var. scabrella (Nieuwl.) Palmer & Steyermark, Ann. Mo. Bot. Gard. 25: 781. 1938.

The writer by an oversight published an unnecessary new combination (Rhodora **42:** 99. 1940). This latter combination should be disregarded in favor of the earlier one by Palmer and Steyermark. An earlier distribution set of the Gray Herbarium Card Index attributed the combination *Silene stellata* var. *scabrella* to Nieuwland (Am. Midl. Nat. 3: 58–59. 1913). This combination was cited as such and attributed to Nieuwland in Deam's Flora of Indiana. It is a question, however, whether Nieuwland should be given as the authority of this combination. In Am. Midl. Nat. **3:** 58. 1913, Nieuwland actually placed his "var. nov." after *Evactoma stellata* var. *scabrella*, while below this category he simply printed in italics "Silene stellata var. scabrella"; in other words, Nieuwland considered the latter name a synonym, and expressed his preference for the name *Evactoma stellata* var. *scabrella*, favoring the use of the genus *Evactoma* over *Silene* throughout the paper. But, according to Art. 40 of the International Rules of Nomenclature "A name of a taxonomic group is not validly published when it is merely cited as a synonym". Therefore, it appears that the name *Silene stellata* var. *scabrella* was not properly published by Nieuwland, and that the combination must be attributed to Palmer and Steyermark in their publication in 1938.

Euphorbia corollata L., var. angustifolia Ell. Sk. **2:** 659. 1824. This variety, distinguished by its linear to linear-lanceolate leaves, has not been reported previously from Missouri. It is represented by the following collection: *Steyermark 27692*, limestone glade on southwest-facing limestone bluffs along Big Maries River, T 42 R, R 10 W, sect. 24 and 25, 5 mi. northwest of Freeburg, Osage Co., July 1, 1939. Another collection from Missouri, belonging to this variety, is in the Herb. Field Mus.; it is "Valley Park, May 29, 1887, *William Trelease.*"

The leaves in this variety average from 3–5 mm. broad and 4–6 cm. long.

Acer nigrum Marsh., f. pubescens Deam, Fl. Ind. p. 657. 1940. This form, distinguished by the petioles more or less pubescent their entire length, was reported from Atherton,

Jackson Co., Missouri, by Deam. A second collection, made recently by the writer, is represented by the following: *Steyermark 22148*, base of rich wooded limestone slopes with Roubidoux sandstone above, along Dry Fork of Meramec River, T 38 N, R 6 W, sect. 33, 4 mi. southeast of St. James, Phelps Co., May 5, 1939.

Elatine triandra Schkuhr, var. americana (Pursh) Fassett. This species has been collected in Missouri in Jackson County (*Bush 131*, 1898), but since that date had never been found in the state. Recently, the writer discovered a second station bordering a sink-hole pond; it is represented by the following collection: *Steyermark 27219*, upland sink-hole pond along highway 5, 7 mi. north of Lebanon, Laclede Co., June 24, 1939.

This pond was at one time, according to the inhabitants in the area, much deeper and contained more water than at present, but, due to the growth and increase of *Nelumbo pentapetala* and *Ludvigia palustris* var. *americana*, it has been filling up gradually. The *Elatine* was rooting on the muddy margin of a raised muddy island in the pond. It is another one of the rare relic species isolated in Missouri around such ponds.

Rotala ramosior (L.) Koehne, var. typica Fern. & Griscom, Rhodora **37:** 169. 1935. The typical variety, distinguished by its generally smaller parts throughout, the plant rarely 2 dm. tall, the leaves 1.5–5 mm. broad, longer-petioled than the var. *interior* Fern. & Griscom, with subulate bractlets 0.5–1.4 mm. long, and smaller fruits (2–3.3 mm. broad and 2–4 mm. long), has a distribution along the coastal plain from Mass. to Fla. and Tex., the sands of southern Michigan, northern Indiana, Illinois, and Minnesota, and also Washington and Oregon. It has not been known from Missouri previously. Throughout the range of the species in Missouri var. *typica* is usually replaced by the larger and coarser *Rotala ramosior* var. *interior*. The writer found recently, however, around one of these upland sink-hole ponds, where so many other relic species of the northern and eastern United States are isolated, a colony that should be referred to *Rotala ramosior* var. *typica*, agreeing with it in all critical details. This is a range extension of several hundred miles for this variety. It is represented by the following collection from Missouri: *Steyermark 27136*, bordering upland sink-hole pond along highway 32, sect. 8, 0.7 mi. east of Lynchburg, Laclede Co., June 23, 1939.

Osmorhiza longistylis (Torr.) DC., var. brachycoma Blake, Rhodora **25:** 110. 1923. This variety, distinguished from *O. longistylis* var. *villicaulis* Fern. by its prevailing puberulence of much shorter hairs at most 0.5 mm. long instead of long villous

pubescence of hairs 1–2 mm. long, has not been known previously from Missouri. It is represented by the following collection: *Steyermark 22179*, upper part of wooded limestone bluffs with Roubidoux sandstone above, along Dry Fork of Meramec River, T 38 N, R 6 W, sect. 33, 4 mi. southeast of St. James, Phelps Co., May 5, 1939.

PENSTEMON DIGITALIS (Sweet) Nutt., forma **Baueri,** f. nov., a typo recedit foliis ternatis.—Wooded southwest-facing limestone bluffs along Maries River, T 43 N, R 10 W, sect. 18, 3 mi. northeast of Westphalia, Osage Co., Missouri, July 1, 1939, *Julian A. Steyermark 27665*, TYPE, in Herb. Field Mus.).

This form, distinguished by its leaves occurring in whorls of threes, is named in honor of my friend, Mr. Bill Bauer, of Webster Groves, Missouri, who accompanied me on this trip and who is an enthusiastic and keen collector.

RUDBECKIA HIRTA L., f. FLAVESCENS Clute, Am. Bot. **21:** 56. 1915. This form, distinguished from typical *Rudbeckia hirta* by its pale yellow rays, has not been previously reported from Missouri. It was originally described from an Illinois plant. In Missouri it is represented by the following collection: *Steyermark 27149*, dry upper cherty slopes along Jack's Fork of Current River, from ½ mi. of Shannon Co. line to near Shannon Co. line, T 28 N, R 7 W, sect. 36, 5½ mi. southeast of Arroll, Texas Co., June 23, 1939.

The plant was growing with typical *R. hirta* (*Steyermark 27150*).

CHRYSANTHEMUM BALSAMITA L., var. TANACETOIDES Boiss. This species, previously unreported from Missouri, has been collected by Mr. *Oscar Petersen*, escaped from a garden, and established along a fence row, in Franklin. Co., during 1940.

HYPOCHAERIS RADICATA L. This species has likewise not been reported previously from Missouri. It is represented from the state by the following collection: *Oscar Petersen*, lawn, Jewish Hospital, St. Louis, St. Louis Co., June 25, 1940.

FIELD MUSEUM OF NATURAL HISTORY,
Chicago, Ill.

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ERRATA

Pagé 307, line 11; *for* petals *read* sepals.
Page 336, line 32; for **purpureum** read *purpureum.*
Page 390, line 2; *for* 2905 *read* 3905.
Page 390, line 3; for *Contance* read *Constance.*
Page 411, line 32; *for* ramibus *read* ramis.
Page 411, line 38; for *A.* read *C.*
Plate 699, in caption; *for* ½ *read* 2.5.
Page 482, line 8; for *trilobum, γ. edule* read *trilobum.* Var. *γ. edule.*
Page 482, line 9; *for* which is *read* is.
Page 486, line 19; for *austromontana* read *austro-montana.*
Page 488, line 13; *for* Surry County *read* Isle of Wight.
Page 524, line 28; *for* endomic *read* endemic.
Page 573, footnote; *for* Petrap. *read* Petrop.
Page 577, line 32; *omit* Bellingham *reference.*
Plate 683, second line of caption; *before* specimen *add* FIG. 1.

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